

A TAXONOMIC REVISION OF *PODOCARPUS*, XI
THE SOUTH PACIFIC SPECIES OF SECTION *PODOCARPUS*,
SUBSECTION B

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THE SPECIES OF *PODOCARPUS* in subsection B (2) of section *Podocarpus* (*Eupodocarpus* of previous papers in this series) are trees and shrubs of southeastern Asia, Australia, and the islands of the western Pacific Ocean, the area covering almost 100° in longitude and 80° in latitude. At present there are twenty-nine species in this group, and in some varieties have been recognized. This subsection is about as large as subsection C (2) of South and Central America. The extent of the southerly range is about the same as subsection C but native specimens of subsection B are found about 10° farther north than are those of the former. Of the twenty-nine species, only three (*Podocarpus neriifolius*, *P. glaucus*, and *P. polystachyus*) have been found both north and south of the Equator. *Podocarpus neriifolius* is found, usually in mountainous regions, throughout the entire area except Australia; *P. polystachyus* occurs at lower altitudes and in the coastal regions of both large and small islands and also in the Malay Peninsula of Asia; *P. glaucus* is of very limited distribution in the mountains of the Philippine Islands and New Guinea.

The observations on leaf anatomy included here were made from transverse sections taken from near or below the middle of the leaf. Sections from other parts of the leaf were also made but it was not found that these added pertinent information. Observations were most easily made from unstained sections dehydrated in glycerine; for permanence some sections were mounted in glycerine jelly. Both the upper and the lower epidermis were examined in flat mounts stained with safranin O in examples of all species.

As in all other subsections of sect. *Podocarpus*, the leaves are hypostomatic and have a single vascular bundle flanked by winglike areas of transfusion tissue. There is always at least one resin canal below the phloem; in all species of this section except *Podocarpus drouynianus* and *P. spinulosus* there are three. In several species a pair of resin canals has also been observed below the vascular bundle near, or even imbedded in, the transfusion tissue (*P. ridleyi* [Fig. 1], *P. deflexus*, usually in *P. salomoniensis*, rarely in *P. elatus*, *P. neriifolius* and *P. archboldii* var. *crassiramosus*). These additional vascular resin canals have not previously been described for this subsection of *Podocarpus*.

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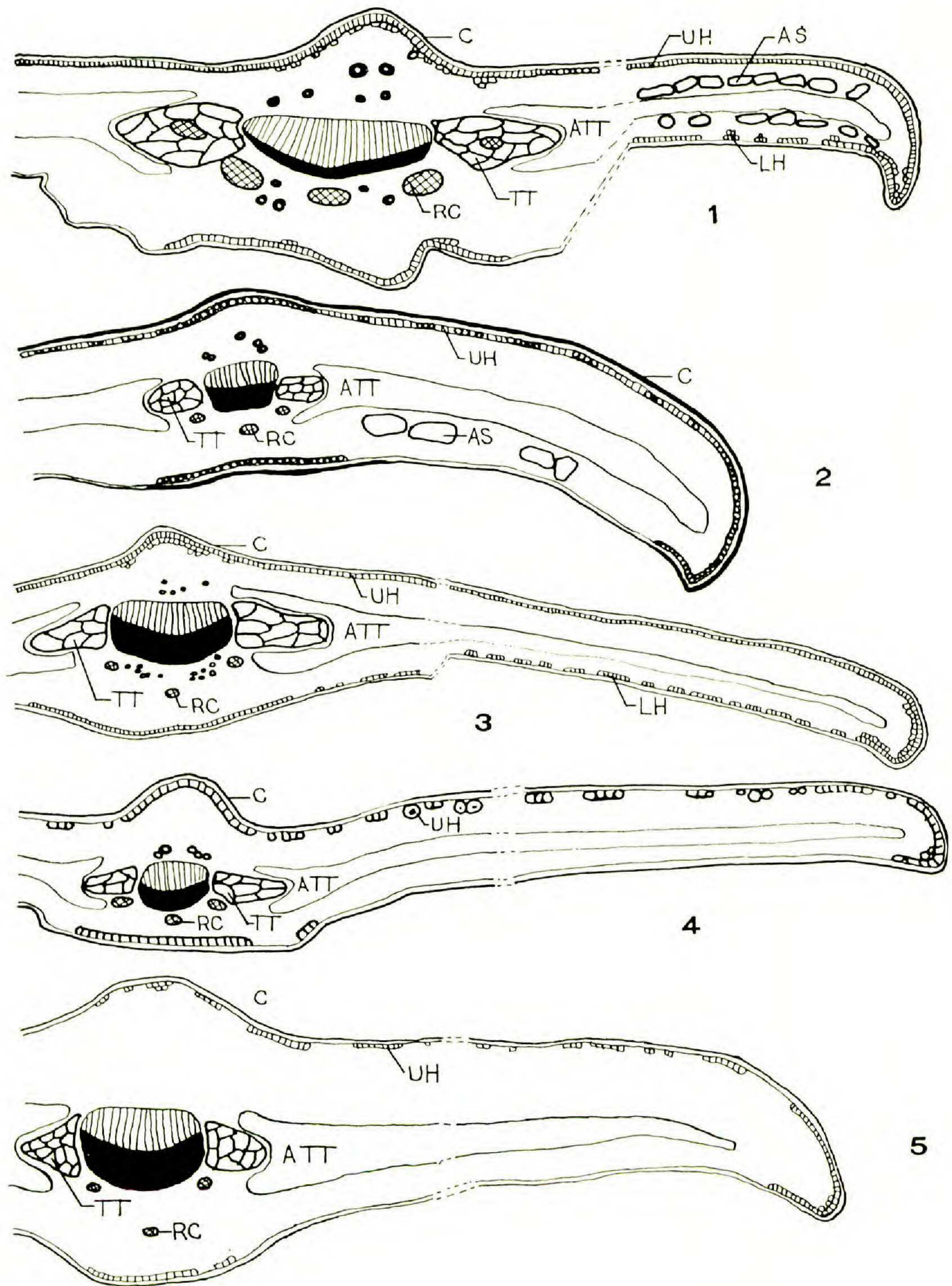
The well-developed accessory transfusion tissue (*Fig. 1*) extends from the transfusion tissue proper to the margins of the leaf, between the layers of mesophyll. The full extent of lignification is observed only in the most mature leaves, but the horizontal orientation of the elongated cells of this tissue may be seen in leaves which are still quite young.

A layer of hypodermis of variable pattern is found between the mesophyll and the epidermis of the leaves. In many species this pattern is consistent and can be used as a reliable taxonomic character. The upper hypodermis is a continuous layer from the midrib to the margin only in *Podocarpus elatus* (*Fig. 3*), *P. philippinensis*, *P. novae-caledoniae*, *P. gibbsii* (*Fig. 2*), *P. koordersii*, and *P. ridleyi* (*Fig. 1*). The use of this diagnostic character was strikingly successful in the identification of a large number of cultivated specimens of *P. elatus* from many parts of the world. In *P. novae-caledoniae* the hypodermis is rarely interrupted. In all the others, it is interrupted between the margin and the midrib, sometimes being represented by only a few fibers. In some cases, the diameter of the fibers can be relied on for specific determinations; for example, they are always large (50μ or more) in *P. polystachyus* (*Fig. 4*) and always small (20μ or less) in *P. macrophyllus* (*Fig. 5*). Lower hypodermal fibers are not found between the stomatal rows in most species. They have been found consistently in *P. novae-caledoniae*, *P. philippinensis*, *P. ridleyi*, *P. elatus*, *P. drouynianus*, *P. spinulosus*, *P. archboldii* var. *crassiramosus*, *P. dispermus*, *P. ledermannii* from New Guinea, *P. sylvestris*, and *P. affinis*. They were found occasionally in *P. rumphii*, *P. neriifolius*, *P. idenburgensis*, *P. polystachyus* var. *rigidus*, *P. pilgeri* and *P. archboldii*; in some of these species, only a few specimens showed these fibers, while in others only a few fibers were found in most of the specimens.

The presence or absence of auxiliary sclereids in the mesophyll was rarely found to be consistent enough for use as a distinguishing character. However, they were always absent in *Podocarpus philippinensis*, *P. glaucus*, *P. brassii*, *P. drouynianus*, *P. spinulosus*, *P. idenburgensis*, *P. dispermus*, *P. macrophyllus* vars. *maki* (*Fig. 5*) and *chingii*, *P. neriifolius* vars. *atjehensis*, *degeneri*, and *polyanthus*, *P. forrestii*, *P. thevetiifolius*, *P. costalis*, *P. pilgeri* in the Philippines, and *P. nakaii*. They were present in only one specimen of *P. elatus*, two specimens each of *P. rumphii* and *P. archboldii*, and several specimens of *P. neriifolius*.

The presence of vascular fibers or sclereids either below or above the bundle was not consistent enough to be diagnostic.

The combination of characters consistent for this subsection as observed in transverse sections of the leaves is: (1) no marginal resin canals (as found in subsection A); (2) no resin canals above the vascular bundle (as found in subsection F); (3) organized accessory transfusion tissue (absent in subsection D); (4) three resin canals below the vascular bundle (with the exception of *P. drouynianus* and *P. spinulosus*; not found in subsections C and D). Subsections B and F are the only subsections of sect. *Podocarpus* with a pair of small, subulate bracts beneath the receptacle which bears the ovule.



FIGURES 1-5. TRANSVERSE SECTIONS OF LEAVES OF *PODOCARPUS*. FIG. 1. *P. ridleyi* (Wasscher) Gray [*Eyma* 4911], showing relative thickness of cuticle (C), continuous upper hypodermal layer (UH) and extent of lower hypodermal fibers (LH), location of vascular resin canals (RC) with two lateral canals embedded in the transfusion tissues (TT), accessory transfusion tissue (ATT), and auxiliary sclereids (AS) in the mesophyll. FIG. 2. *P. gibbsii* Gray [*Clemens* 32021], with upper hypoderm of alternating thick- and thin-walled fibers and auxiliary sclereids only below the accessory transfusion tissue. FIG. 3. *P. elatus* R. Br. [*Laserson* 435], showing upper hypoderm continuous and auxiliary sclereids lacking. FIG. 4. *P. polystachyus* R. Br. [*G. L. Smith s.n.*], with scattered large upper hypodermal fibers. FIG. 5. *P. macrophyllum* var. *maki* Endlicher, illustrating thickness of leaf and small, scattered upper hypodermal fibers. All figures ca. $\times 20$.

Within subsection B, anatomical characters of the leaves alone are not sufficient to determine the species. Nor have leaf-size and -shape, terminal bud shape, buds or cones of male strobili, length of peduncle, or size and shape of seed, proved to be reliable when used individually. Combinations of some or all of these characters are needed to differentiate the various species. Because so many of the specimens encountered are sterile, vegetative characters have been used insofar as possible in the preparation of the following key.

KEY TO SECT. PODOCARPUS (SOUTH PACIFIC SPECIES), SUBSECTION B

- A. Leaves with continuous upper hypoderm (*Figs. 1, 2, 3*).
- B. Leaves rarely over 5 cm. long; Borneo. 1. *P. gibbsii*.
- BB. Leaves over 5 cm. long.
- C. Leaves not more than 5 mm. wide, the midrib flat or concave above; New Caledonia. 2. *P. novae-caledoniae*.
- CC. Leaves over 5 mm. wide, the midrib prominent above.
- D. Leaves without lower hypodermal fibers between the stomatal rows; Java & Celebes. 3. *P. koordersii*.
- DD. Leaves with lower hypodermal fibers between the stomatal rows (*Figs. 1, 3*).
- E. Leaves 13–23 cm. long; terminal buds globose; Philippine Islands. 4. *P. philippinensis*.
- EE. Leaves usually less than 15 cm. long; terminal buds ovate.
- F. Apex of leaves usually long-acute or -acuminate; leaves with 3–5 vascular resin canals, upper hypodermal fibers large; Malay Peninsula & Borneo. 5. *P. ridleyi*.
- FF. Apex of leaves obtuse, often mucronate; leaves with 1–3 vascular resin canals, hypodermal fibers not over 22 μ in diameter; Australia. 6. *P. elatus*.
- AA. Leaves with interrupted upper hypoderm (*Figs. 4, 5*).
- G. Leaves not over 6.5 mm. broad.
- H. Leaves not over 2.5 cm. long, rarely over 5 mm. wide.
- I. Terminal buds large, globose; pollen cones thick; New Guinea, above 3000 m. 7. *P. brassii*.
- II. Terminal buds small; leaves glaucous when young; pollen cones slender; Mindoro & New Guinea. 8. *P. glaucus*.
- HH. Leaves over 2.5 cm. long.
- J. Leaves not over 5.5 cm. long, erect and adpressed to twig; Philippines, Borneo, China. 9. *P. brevifolius*.
- JJ. Leaves usually over 5.5 cm. long.
- K. Leaves pungent; seed strongly beaked; southeastern Australia. 10. *P. spinulosus*.
- KK. Leaves rarely pungent; seed with rounded apex.
- L. Leaves 5–12 cm. long, sessile, grasslike, with 1 vascular resin canal; western Australia. 11. *P. drouynianus*.
- LL. Leaves 6–9 cm. long, petiolate, with 3 vascular resin canals; New Caledonia. 2a. *P. novae-caledoniae* var. *colliculatus*.

- GG. Leaves (at least some of them) over 6.5 mm. broad.
- M. Leaves with lower hypodermal fibers between the stomatal rows.
- N. Leaves mostly less than 10 cm. long.
- O. Leaves less than 5.2 cm. long; Fiji. 12. *P. affinis*.
- OO. Leaves usually over 5.2 cm. long.
- P. Midrib of leaves channelled below; Borneo.
. 28a. *P. polystachyus* var. *rigidus*.
- PP. Midrib of leaves not channelled below.
- Q. Twigs very stout; leaves with acute or acuminate tips;
New Guinea. . . 20a. *P. archboldii* var. *crassiramosus*.
- QQ. Twigs slender; leaves with rounded obtuse apex; New
Caledonia. 13. *P. sylvestris*.
- NN. Leaves over 8 cm. long.
- R. Leaves 9–15 mm. wide; New Guinea. . 14. *P. idenburgensis*.
- RR. Leaves 17–30 mm. wide.
- S. Seeds solitary, 8 mm. long; New Guinea.
. 15. *P. ledermannii*.
- SS. Seeds usually in pairs, 2.5 cm. long; Australia.
. 16. *P. dispermus*.
- MM. Leaves mostly without lower hypodermal fibers between the stomatal
rows.
- T. Leaves with auxiliary sclereids.
- U. Leaves narrow, 6.5–9 mm. wide; Solomon Islands.
. 17. *P. salomoniensis*.
- UU. Leaves wider, over 9 mm.
- V. Leaves strongly deflexed, with 5 vascular resin canals;
Malay Peninsula. 18. *P. deflexus*.
- VV. Leaves not deflexed, with 3 vascular resin canals; Annam,
Indochina, Hainan. 19. *P. annamiensis*.
- TT. Leaves usually without auxiliary sclereids.
- W. Leaves for the most part deflexed; Sumatra.
. 27a. *P. neriifolius* var. *atjehensis*.
- WW. Leaves erect, spreading or divaricate.
- X. Terminal buds globose or ovate, obtuse.
- Y. Margins of leaves revolute; New Guinea.
. 20. *P. archboldii*.
- YY. Margins of leaves not revolute.
- Z. Leaves 8–11 mm. broad; Formosa. . 21. *P. nakaii*.
- ZZ. Leaves mostly more than 10 mm. broad.
- a. Leaves with parallel margins, the apex usually
short-angustate; Borneo, New Guinea, etc.
. 22. *P. rumphii*.
- aa. Leaves lanceolate, the apex caudate-acuminate;
Sumatra, etc.
. 27d. *P. neriifolius* var. *teysmannii*.
- XX. Terminal buds ovate, conical, acute.
- b. Upper midrib of leaf broadly prominent or flat.
- c. Peduncles of female cones 2 mm. long; Philippines,
Formosa, shores. 23. *P. costalis*.
- cc. Peduncles of female cones over 2 mm. long.
- d. Upper hypoderm of large fibers; New Guinea.
. 24. *P. thevetiifolius*.

- dd. Upper hypoderm of small fibers; China. 25. *P. forrestii*.
- bb. Upper midrib of leaf narrowly prominent.
 - e. Male cones usually solitary.
 - f. Leaves usually less than 8 cm. long, apex usually obtuse, apiculate; Philippine to Solomon Islands. 26. *P. pilgeri*.
 - ff. Leaves usually 8 cm. long or more, the apex usually acute to acuminate; entire area except Australia. 27. *P. neriifolius*.
 - g. Leaves usually less than 10 mm. wide; Fiji. 27b. *P. neriifolius* var. *degeneri*.
 - gg. Leaves usually over 10 mm. wide; female cones numerous all over youngest growth; Sumatra & New Guinea. 27c. *P. neriifolius* var. *polyanthus*.
 - ee. Male cones usually clustered.
 - h. Leaf with upper hypoderm of very large fibers; Philippines to Bangka. 28. *P. polystachyus*.
 - hh. Leaf with upper hypoderm of small fibers.
 - i. Leaves 9–11 mm. broad; China & Japan. 29. *P. macrophyllus*.
 - ii. Leaves less than 9 mm. broad.
 - j. Leaves more than 4.5 mm. broad.
 - k. Leaves 5.5–12 cm. long \times 5.5–8 mm. broad; China, Japan & Burma. 29a. *P. macrophyllus* var. *angustifolius*.
 - kk. Leaves 3.5–7 cm. long \times 4.5–8 mm. wide; China, Japan, Formosa & Burma. 29c. *P. macrophyllus* var. *maki*.
 - jj. Leaves less than 4.5 mm. broad; China. 29b. *P. macrophyllus* var. *chingii*.

1. *Podocarpus gibbsii*, sp. nov.

Arbor 10–20 m. alta, ad 20 cm. diametro; ramulis erectis; alabastris perminutis ovatis, 1.5 mm. diametro, squamis paucibus exterioribus lanceolatis, carinatis, rectis, ad 6 mm. longis, apiculatis longi-acuminatis, aliquando foliaceis; foliis 1.3–2.1 cm. longis, 4–6 mm. latis, spathulatis, interdum ellipticis vel lanceolatis, coriaceis, planis, apice obtusis vel acutis, basi in petiolum brevem crassum angustatis; costa supra manifesta, subtus plana et inconspicue; strobilis masculis axillaribus, sessilibus, solitariis vel duobus, squamis exterioribus confertim imbricatis, deltoideis, apice longe acuminatis; strobilis femineis et seminibus ignotis.

DISTRIBUTION: Edges of low jungle, 1600–2300 m. altitude, Mt. Kinabalu, British North Borneo.

British North Borneo. Marai Parai, near camp, *Clemens 32021* (TYPE, A; †BM,

† This symbol preceding the abbreviation of an herbarium signifies that the details of the leaves of this specimen have been examined in transverse section.

†NY, †UC);* Marai Parai spur, *Gibbs 4092* (†BM); Colombon Basin, *Clemens 40001* (A, †NY, †UC).

This small tree of apparently very limited range may be described in somewhat further detail. The inner scales of the very small vegetative terminal buds are thinner than the outer ones and have merely acuminate tips. The extreme margins of the short, spatulate leaves are slightly recurved and the sharply prominent midrib above becomes flat toward the apex. Juvenile leaves may be up to 5.2 cm. long and 9 mm. wide. Transverse sections of the leaves (*Fig. 2*) show three vascular resin canals, upper hypoderm in a continuous single layer except at the margin and midrib (some fibers with large lumen), lower hypodermal fibers absent between stomatal rows, vascular sclereids abundant above and rare below the bundle, the single layer of palisade mesophyll composed of large cells often almost as broad as long, mesophyll cell walls, especially the lower, lignified but not pitted and thickened as much as is usual for most auxiliary sclereids.

Podocarpus gibbsii differs from the other species in having continuous upper hypoderm in its very short, broad, spatulate leaves. The two Clemens specimens were used by Wasscher (11) for his description of *Podocarpus glaucus* but these differ from Foxworthy's description of that species in that the young foliage is not glaucous and, in addition, the leaves have a continuous upper hypoderm. Only *Clemens 40001* is fertile, bearing male cone buds and immature cones. I do not understand the description "tiny yellow pistils" written on the label of this specimen, for the species is dioecious and I cannot find any structures to which the note might apply. The upper hypodermal fibers in the leaves of the Clemens specimens show clearly the alternation of groups of fibers with open and closed lumina. This was erroneously described by Orr (9) for *Podocarpus glaucus*. Orr did not observe the lignification of cell walls in the mesophyll, particularly the lower, where an almost continuous layer is formed. This is very apparent in cleared and stained whole mounts of leaves. *Gibbs 4092* has more scattered, larger, acute-tipped leaves which are a normal juvenile variation in most podocarps.

This species is named in honor of Dr. L. S. Gibbs, who first collected it on Mt. Kinabalu.

* The following symbols indicate the location of the specimens cited: Academy of Natural Sciences of Philadelphia (PH); Arnold Arboretum (A); Bernice P. Bishop Museum, Honolulu (BISH); Brisbane Herbarium of Agriculture (BRI); British Museum of Natural History (BM); Brussels Botanical Garden (BR); University of California at Berkeley (UC) and at Los Angeles (UCLA); California Academy of Science (CAS); Chicago Natural History Museum (Field Museum) (F); Cornell University (CU); Dudley Herbarium at Stanford (DS); Edinburgh Royal Botanic Garden (E); Gray Herbarium (GH); University of Illinois Herbarium (ILL); Royal Botanic Gardens, Kew (K); McGill College Herbarium, Montreal (MTMG); Missouri Botanical Garden (MO); Department of Forests of New Guinea and Papua (LAE); New Jersey College for Women (Rutgers) (RUT); New York Botanical Garden (NY); Paris Muséum National d'Histoire Naturelle (P); Pennsylvania University Herbarium (PENN); United States National Herbarium (US); Victoria National Herbarium, Melbourne (MEL).

Stapf, when determining and describing the specimens for Gibbs (6), described but did not identify two specimens of *Podocarpus* (*Gibbs* 4089, 4092). *Gibbs* 4092 (BM), which I examined, resembles Stapf's description of *Gibbs* 4089. Either the numbers were reversed in attaching the labels to the specimens or Stapf reversed the descriptions. Stapf's description of *Gibbs* 4092, "a very striking species with fairly crowded leaves, oblong-linear, obtuse or sub-obtuse at the apex, attenuated at the base, 1.5–2 cm. long, 3.5–4.5 mm. broad, with the margins recurved, the midrib raised above and rather broad and flat beneath," shows that this plant is like the two Clemens specimens and is, therefore, *Podocarpus gibbsii*, the new species. The other specimen, *Gibbs* 4089, is said to have "leaves, in shape and size, intermediate between those of *P. brevifolius* and *P. polystachyus* but thinner and much more loosely arranged than either." This is like the British Museum's specimen of *Gibbs* 4092 and, therefore, is probably also *P. gibbsii*. Wasscher (11, p. 471) lists these specimens under doubtful species. His suggestions that *Gibbs* 4089 is *P. pilgeri* and *Gibbs* 4092 is *P. glaucus* are untenable.

2. *Podocarpus novae-caledoniae* Vieillard ex Brongn. & Gris, Bull. Soc. Bot. France 13: 425. 1866; Parlato, DC. Prodr. 16: 513. 1868; Pilger, Pflanzenreich IV. 5(Heft 18): 76. 1903, Nat. Pflanzenfam. ed. 2. 13: 248. 1926; Compton, Jour. Linn. Soc. Bot. 45: 425. 1922; Dallimore & Jackson, Handb. Conif. 53. 1923, 1931, 78. 1948; Florin, Svenska Vet.-Akad. Handl. III. 10: 279. 1931.

P. ensifolia Carrière, Traité Conif. ed. 2. 655. 1867 (non R. Br.).

A shrub (seldom a small tree up to 3 m. high) with erect crowded branches. Terminal buds ovate, 2–3 mm., the long triangular scales with acuminate apex. Leaves linear, crowded, more or less erect, leathery, 4–9 cm. long, 3–5 mm. broad, the apex short-acuminate or rarely long-attenuate and sometimes pungent, gradually narrowing at the base to a short obscure petiole; margins blunt with sharply recurved edges but not revolute; midrib shallowly concave or flat above. Transverse sections of the leaves with three vascular resin canals (rarely only one); upper hypoderm usually in a single continuous layer except at the margin and midrib where it is doubled, lower hypodermal fibers not abundant between stomatal rows, fibers averaging 20–30 μ in diameter; vascular fibers few above but numerous between the vascular bundle and central resin canal; auxiliary sclereids in the mesophyll so abundant as to form a distinct layer between the palisade mesophyll and accessory transfusion tissue; cuticle thick. Male cones axillary, in pairs, sessile, surrounded at the base by stiff obtuse scales. Microsporophylls densely imbricate, each with a short rotundate apiculus. Female cones axillary and solitary on peduncles 7–10 mm. long, the fleshy receptacle subtended by two minute scales and bearing 1–2 ovules. Seeds ellipsoid, shiny, 7–8 mm. long, 4 mm. wide.

DISTRIBUTION: Stream banks, at low altitudes, New Caledonia.

New Caledonia. River Dumbea, *Vieillard* 1266 (ISOTYPE, A, BM, GH, K, P), *Compton* 402, 419 (BM), *Buchholz* 1133, 1137, 1139, 1255, 1477 (ILL), 1759 (†ILL), *Franc* 96 (BM, NY, UC), *Anon. s.n.* (BM), *Pancher* (P), *Balansa* 189 (P), *Godefroy* 552 (P), *LeRat* 603, 1587 (P); Rio des Pirogues, *White* 2231 (A-2 sheets, BRI, DS, K, P, UC-2 sheets, US), *Buchholz* 1340 (ILL); Rivière Camboui, *Compton* 2017, 2169 (BM); Couvélée, *Franc* 2408 (A-2 sheets, BRI, †F, K, NY, P, UC, US); Table Unio, *Lecard s.n.* (BM, P), *Lecard* 92 (P); Port Bouquet, *Balansa* 704 (NY), 2504 (K, P); Bourail, *Pennel s.n.* (P); Mt. Mou, *Franc* 107 (K), *Glandoger* in 1906 (†MO); Mt. Dore, *Vieillard & Pancher* 396 (P); Mt. Koghi, *LeRat* 2372 (P); Rive gauche de la Toutouta, *Viro*t 369 (A); Prony, *Franc* 94A (BM), 96A (BM, K-2 sheets, US), *s.n.* (BM), *Franc* in 1913 (A-7 sheets, F, GH, NY, UC-2 sheets), *MacDaniels* 2540 (†CU), *Juillet* 96 (BRI, US). Locality unknown: *Pancher* ex Hennecart in 1879 (K, NY), *Pancher* in 1870 (†BR, K-2 sheets, †UCLA), *Franc* 90 (†UC), *Baudouin* 635 (P).

Podocarpus novae-caledoniae is a low, rounded shrub rarely forming a small tree when growing in a thicket with other vegetation. The young leaves are glaucous, becoming dark green when older (3). According to Buchholz (ms.), there seem to be differences in the thickness of the leaves, as specimens found in Plaine des Lacs and near Prony have leaves more coriaceous than those found in the Dumbea valley. This is not apparent in transverse sections of the leaves. Compton (3) described the fleshy receptacle as becoming bright scarlet or purple, soft, translucent, and sweet to the taste, whereas Buchholz (ms.) says that it turns yellow or brick red. These variations may merely be due to different stages of maturity of the fruit.

Orr (9) examined the leaf anatomy of *Podocarpus novae-caledoniae* and described most of the above characters. He does not seem to have observed the lower hypodermal fibers between the stomatal rows since he did not include this species in his list of those showing this character.

2a. *Podocarpus novae-caledoniae* var. *colliculatus*, var. nov.

Frutex vel arbuscula, 1 m. alta; foliis coriaceis, linearibus, saepe falcatis, 6-9 cm. longis, 5-6.5 mm. latis, apice coarctis acutis vel rare acuminatis, basi in petiolum 1-4 mm. longum sensim angustatis; strobilis masculis alabastris immaturis, globosis, cum squamis brevibus adpressis; strobilis femineis seminibusque ignotis.

DISTRIBUTION: Isle of Pines, New Caledonia, at 80 m. altitude, and possibly on New Caledonia itself.

New Caledonia. *Germain* in 1874-76 (†P). ISLE OF PINES: Pic N'Ga, *Viro*t 1053 (Type, †ILL; NOUMEA).

The description of *Podocarpus novae-caledoniae* var. *colliculatus* was prepared only from *Viro*t 1053. I am in doubt as to whether the *Germain* specimen really came from New Caledonia. The terminal buds of the twigs of this variety have short, thin, appressed scales very similar to those of the species. The midrib of the leaf is flat or broadly rounded above and broadly prominent or ridged below. Transverse sections of the leaves of

both collections cited above are very similar. These show three vascular resin canals, an interrupted upper hypoderm, rare lower hypodermal fibers, vascular sclereids above and below the bundle and auxiliary sclereids in the mesophyll. That the upper hypoderm is occasionally interrupted instead of being a continuous layer is in contrast to the main species. The low, shrubby habit is in agreement but the broader leaves with a definite petiole and the occasionally interrupted upper hypoderm differentiate the variety. In these latter characters it is like *P. sylvestris* but this is a tree and the leaves are mostly broader. The vegetative buds of all three of these taxa are similar.

3. *Podocarpus koordersii* Pilger ex Koorders & Valetton, Meded. Lands Plant. [Batavia] 68: 268. 1904; Nat. Pflanzenfam. ed. 2. 13: 248. 1926; Florin, Svenska Vet.-Akad. Handl. III. 10: 279. 1931; Wasscher, Blumea 4: 433. 1941.

A small tree, to 14 m. tall, with stout twigs. Vegetative buds globose with thick, broad, obtuse or roundish scales, the outer ones sometimes acuminate. Leaves spreading, thickly coriaceous, rigid, glossy above, straight or somewhat falcate, linear or linear-lanceolate, 9–21 cm. long, 6–13 mm. wide (larger on sterile twigs), gradually narrowing to a short thick petiole and acute apex; midrib broad and usually roundly prominent on both surfaces. Transverse sections of the leaves with 3 vascular resin canals below the bundle, with vascular fibers always above and sometimes below, isolated auxiliary sclereids in the mesophyll both above and below the accessory transfusion tissue, upper hypoderm fibers in a continuous layer, doubled at the margin and midrib, absent below between the stomatal rows, small, 16–24 μ in diameter. Male cones axillary, sessile, in fascicles of 2–8, the buds globose with thick rounded scales; mature cones 4.5 cm. long, 2 mm. in diameter. Microsporophylls broadly triangular, each with a small apiculus. Female cones unknown.

DISTRIBUTION: From sea level to 50 m. in Java and up to 300 m. in Celebes.

Java. *Koorders* 39480 (TYPE, †via Florin ex Leiden Herbarium); *Anon.* (†via Florin ex Berlin Herbarium); Banjumas, *Koorders* 40251 β (†A); *Horsfield* s.n. (†BM), *Horsfield* in 1859 (†MEL). Celebes. Malili, Oesoe, *Cel/II-285* (A), *Cel/II-287* (†BRI), *Cel/II-288* (†BISH). San Cristobal. BSIP on ridge, *Logie* BSIP 356 (†LAE).

Podocarpus koordersii differs from *P. neriifolius* in having leaves with margins parallel over a greater length, a broader, less prominent midrib and a continuous upper hypoderm (as seen in transverse sections). The specimens from Java all have rounded or obtuse vegetative bud scales but those from Celebes have acuminate tips on the outer bud scales. In most of the leaves of *P. koordersii* the upper hypodermal fibers show alternate groups of thick-walled cells with small lumina and thinner-walled cells with large lumina. This is especially apparent in the specimens from

Celebes, in which I find also that the mesophyll above and below the accessory transfusion tissue is an almost complete layer of thin-walled sclerenchymatous cells with simple pits, very large and empty of cell contents. Wasscher (11) referred to *P. rumphii* a group of specimens from Celebes with related collection numbers, including those I have examined, but he says that they have very small, more lanceolate leaves. This and the continuous upper hypoderm readily refer them to *P. koordersii*. Orr (9) also examined *P. rumphii* and agrees that this species has interrupted upper hypoderm while in *P. koordersii* it is continuous.

4. *Podocarpus philippinensis* Foxworthy, Philip. Jour. Sci. Bot. 6: 163. 1911; Pilger, Nat. Pflanzenfam. ed. 2. 13: 248. 1926; Florin, Svenska Vet.-Akad. Handl. III. 10: 280. 1931.

Large, straight trees, 20–30 m. tall, with smooth reddish-brown flaky bark and erect branchlets. Terminal buds globose with thick ovate scales, the tips rather acute but sometimes very blunt. Leaves erect or erect-spreading, straight to subfalcate, linear-lanceolate, 13–23 cm. long, 9–18 mm. wide (juvenile to 31 cm. long, 25 mm. wide), the apex acute to acuminate, gradually narrowing at the base to a short petiole; midrib mostly flat or somewhat depressed, broadly prominent below. Transverse sections of the leaves show three vascular resin canals, vascular sclereids or fibers rare above and absent below the bundle, no auxiliary sclereids, upper hypoderm in a continuous single layer except at the margin and midrib where it is doubled, lower hypodermal fibers abundant between stomatal rows, the small fibers 15–22 μ in diameter. Male cones unknown. Female cones axillary, on peduncles 5–8 mm. long; receptacle fleshy, subtended by two small bracts, bright red. Seeds ellipsoid-globose, 12–15 mm. long, 11 mm. wide, the crest suppressed.

DISTRIBUTION: On mountain slopes in the Philippine and Selangan Islands.

Philippine Islands. LUZON. Bataan Prov.: Lamao Forest Preserve, For. Bur. 6326, *Curran* (BISH, BRI, †MO, NY); For. Bur. 8987, *Curran* (†MO, NY); For. Bur. 17523, *Curran* (†BR), For. Bur. 17592, *Curran* (NY), For. Bur. 17594, *Curran* (†BM); Mt. Mariveles, For. Bur. 2743, *Borden* (NY). Pampanga Prov.: Mt. Arayat, For. Bur. 17664, *Curran* (†NY, †P), *Merrill 3917* (†NY). Tabayas Prov.: *Merrill 1992* (MO); Alikad, *Jones 63* (†F–2 sheets). Locality unknown: *Anon. s.n.* (†UC). Selangan Islands. *Cons. For. N. Borneo s.n.* (†E).

Podocarpus philippinensis was distinguished by Foxworthy from *P. rumphii* by the smooth reddish-brown flaky bark, the leaves narrowing more gradually toward the petiole and the seeds with shorter peduncles. With the exception of *Jones 63* and *Merrill 1992*, all the collections listed by Foxworthy were examined and all are either female or sterile. Foxworthy (5) left under *P. rumphii* several specimens, one of which (*Merrill 3917*) is certainly *P. philippinensis*, for an examination of a transverse section of a leaf showed the same continuous upper hypoderm characteristic

of this species. I have not seen the other specimens, but they are probably also *P. philippinensis* as the larger leaves and longer peduncles which they may show seem to be natural variations in most species of *Podocarpus*. Wasscher (11), who does not recognize *P. philippinensis*, saw many of the same collections and included them under *P. rumphii* without comment. The upper hypoderm is so consistently continuous in *Podocarpus philippinensis* that his treatment of these specimens is not tenable.

Orr (9) agrees that the leaves of *Podocarpus philippinensis* differ from those of *P. rumphii* by the continuous hypoderm, an evident but not very prominent upper midrib, the absence of sclereids in the mesophyll, and no auxiliary sclereids. This description of the leaf anatomy resembles that of *P. elatus*, an Australian species. It differs from *P. koordersii* only in the lower hypodermal fibers between the stomatal rows and the absence of auxiliary sclereids. I do not find that the hypodermal fibers are as large compared with those of *P. koordersii* as described by Orr (9).

Orolfo 3919, from the Selangan Islands, agrees with *Podocarpus philippinensis*. It had been identified by Orr (9) as *P. teysmannii* but, on examination of authentic material of this latter species, I find that it is quite different.

5. *Podocarpus ridleyi* (Wasscher), stat. nov.

Podocarpus neriifolius var. η *ridleyi* Wasscher, *Blumea* 4: 453. 1941.

A small tree with stout branches but small verticillate twigs. Terminal buds ovate with long-acuminate outer scales up to 13 mm. long. Leaves crowded on new growth, spreading, stiffly coriaceous, linear-lanceolate, straight or falcate, 10–15 cm. long. 9–12 mm. wide (rarely to 17 cm. long, 19 mm. wide), narrowing at the base to a short petiole, gradually narrowing to an acute or acuminate apex; midrib flat or broadly prominent above, more prominent below. Transverse sections of the leaves show 3–5 vascular resin canals, the two outermost often located within the transfusion tissue on either side of the bundle, vascular fibers above the bundle and usually below, upper hypodermal fibers in a continuous layer, usually large, 22–50 μ in diameter, lower hypodermal fibers also large and scattered or abundant between the stomatal rows, auxiliary sclereids often abundant in the palisade layer and mesophyll both above and below the accessory transfusion tissue. Male cones axillary, sessile or on peduncles up to 2 mm. long, fascicled 1–3, buds small, ovate, the outer scales keeled, acute, 2–4 mm. long, with erose scarious margins; mature cones large, cylindrical, up to 8 cm. long, 4 mm. wide. Female cones solitary, axillary; peduncles to 9 mm. long; immature receptacle subtended by two subulate bracts 2.5 mm. long. Mature seed not seen.

DISTRIBUTION: On mountains, up to 1000 m. altitude, Malay Peninsula, Borneo, and New Guinea.

Malay Peninsula: Johore, Gunong Blumut, *Holtum* 10720 (TYPE, \dagger A); Malacca, Padang Bata, *Ridley* 10016 (A). Borneo: western part, G. Semedoen,

Hallier 720 (†NY, UC). Netherlands New Guinea: Seroei, Japen, *Boschpr.* bb30484, (†A), bb30650 (†A); Japen, Soemberbaba near Seroi, *Van Dijk* 830 (†A); Wissel Lake region, environs of Post, on foot of Mt. Boebeiro, *Eyma* 4911 (†A). Cultivated. JAVA: Buitenzorg Botanic Garden, *V.F.31* (†MO-3 sheets).

Podocarpus ridleyi is a common tree on Gunong Blumut and, according to Holttum in Wasscher (11), it is a very striking plant with its yellow-green leaves. Leaves of these specimens are superficially similar to those of *P. koordersii*, *P. philippinensis*, *P. rumphii* and *P. neriifolius*, but can be distinguished from each of these species by the anatomy of the leaf as observed in transverse sections (*Fig. 1*). The most striking feature is the presence of five vascular resin canals in the leaves of all specimens except *Hallier* 720. Five vascular resin canals have been found elsewhere only in *P. deflexus* (Malay Peninsula), *P. salomoniensis* (Solomon Islands), some specimens of *P. neriifolius* and *P. decipiens* (Fiji Islands), and *P. ulugurensis* (Africa). Only the first three of these are in this subsection of sect. *Podocarpus*. The continuous upper hypoderm is similar to that of *P. koordersii* and *P. philippinensis*, but *P. koordersii* does not have lower hypodermal fibers between the stomatal rows and *P. philippinensis* does not have auxiliary sclereids; the hypodermal fibers are larger in *P. ridleyi* than in either of these species. In most of the specimens of *P. ridleyi* the upper hypoderm consists of alternating groups of thick- and thin-walled fibers as has been described for some specimens of *P. koordersii*.

The specimens of *Podocarpus ridleyi* have had various identifications. Both *Holttum* 10720 and *Hallier* 720 have been identified with *P. neriifolius* and Wasscher lists them in his new variety *ridleyi* under this species. Both the continuous upper hypoderm and hypodermal fibers between the stomatal rows differ from *P. neriifolius* and the specimens are an entirely distinct species. Two of the specimens from Java had been named as *P. macrophyllus*, a species having smaller leaves with interrupted upper hypoderm of very small fibers and a very prominent midrib. The other specimen was called *P. rumphii* which I have found to be a species also with interrupted upper hypoderm.

In *Hallier* 720, from Borneo, the upper hypodermal fibers are smaller in diameter, usually not over 18 μ , and only three vascular resin canals have been observed. Rare interruptions were found in the upper hypoderm of *Holttum* 10720. There seem to be no vascular fibers below the bundle in the three cultivated specimens (two male, one sterile) from Buitenzorg collected by *Sargent* in 1903.

6. *Podocarpus elatus* R. Brown ex Mirb. Geogr. Conif. in Mém. Mus. 13: 75. 1825 (nomen!); Endlicher, Syn. Conif. 213. 1847; Gordon, Pinetum, ed. 1. 273. 1858, ed. 2. 334. 1875; Carrière, Traité Conif. 656. 1867; Parlatoire in DC. Prodr. 16: 517. 1868; Bentham, Fl. Austral. 6: 246. 1873; Van Tieghem, Bull. Soc. Bot. France 38: 169. 1891; Hemsley, Jour. Linn. Soc. Bot. 30: 199. 1894; Bailey, Queensl. Fl. 5: 498. 1902; Pilger, Pflanzenreich IV. 5(Heft 18): 75. 1903, Nat.

Pflanzenfam. ed. 2. 13: 248. 1926; Gibbs, Jour. Linn. Soc. Bot. 39: 183. 1909; Baker & Smith, Res. Pines Austr. 435. 1910; Dallimore & Jackson, Handb. Conif. 43. 1923, 1931, 66. 1948; Florin, Svenska Vet.-Akad. Handl. III. 10: 279. 1931.

P. ensifolia R. Br. ex Gordon, Pinetum ed. 1. 275. 1858; ed. 2. 335. 1875 (non Carr.).

P. acicularis Van Houtte ex Gordon, Pinetum ed. 1. 275. 1858.

P. falcata A. Cunn. Herb. fide Baker & Smith, Res. Pines Austr. 435. 1910.

Nageia elata F. Mull. Cens. 109. 1882.

An erect tree up to 30 m. high with solitary or verticillate branches bearing spreading, rather lax leaves. Vegetative buds small, ovate or subglobose with short, more or less sharply acute scales. Leaves light green and shiny above, coriaceous, straight or subfalcate, linear-lanceolate, the acute to obtuse apex often mucronate, gradually tapering at the base to a short petiole, 5–11 cm. long, 7.5–10 mm. wide (occasionally up to 20 cm. long, 16 mm. wide). Midrib broad and slightly prominent above, scarcely evident below; leaf margins sometimes slightly thickened, never revolute. Transverse sections of the leaves (*Fig. 3*) usually show three vascular resin canals (only one resin canal in the leaf examined of the type, *Brown 3117*, one to three in *Laserson 435*, one in *Anon. 10545* from Mt. Spergeon, and one to three in two cultivated specimens from Rome and California), vascular fibers rare above the bundle but usually abundant below, auxiliary sclereids absent in the mesophyll, palisade mesophyll thick but of a single layer of cells, upper hypoderm in a neat single continuous layer except at the margin and midrib where it is doubled, lower hypodermal fibers abundant between stomatal rows, both upper and lower fibers averaging 15–22 μ in diameter. Pollen cones axillary and sessile, in groups of 2 or 3, 5 cm. long, 4–5 mm. wide, surrounded at the base by numerous thick broad obtuse scales. Microsporophylls densely imbricate, broadly triangular with a short apiculus. Female cones solitary in the axils of the leaves, on stout peduncles 3–10 mm. long; receptacle of two fused thickened equal bluish scales scarcely free at the tips and subtended by a pair of small subulate bracts. Seeds globose, 12–14 mm. wide (22 mm. long on Mt. Spergeon), with very blunt inconspicuous crest.

DISTRIBUTION: Native to southeastern Australia (Queensland, New South Wales) and Tasmania. Cultivated as an ornamental around the world.

Australia. QUEENSLAND: Cape York Peninsula, 100 mi. south of Cape York, *Hartmann* in 1886 (†MEL); Fitzroy Island, *Moore 39* (†MEL); Rockingham Bay, *Mueller* in 1864 (2 sheets, ♂ and ♀, †MEL); Barron River, Kenevunga, *Cowley 52* (BRI); Mt. Spergeon, *Anon. 10545* (†BRI); South Kennedy Dist., Dalrymple Heights, *Sclemers* in 1947 (BRI); Bundaberg, *Keep* in 1898 (BRI); Gympie Dist., *Kenny* in 1907 (BRI); Beech Mountain, *White* in 1923 (BRI, †BR), *Wilson* in 1921 (†A, seedling); Brisbane River, Ithaca Creek, *Bailey* in 1875 (BRI), Moreton Bay, *Mueller* in 1855 (MEL); Pioneer River, *Griffiths* in 1889 (MEL). NEW SOUTH WALES: Moore Park near Kyogle, *White 12579* (MO, UC); Rich-

mond River, *Henderson 106* (MEL); Casino, *McLean* in 1918 (BRI); Ballina, *Baker* in 1892 (†BR); Clarence River, *Beckler* s.n. (MEL); Hastings River, *Beckler* s.n. (MEL); Gloucester River, *Betche* in 1882; Tiona, south of Forster, *Garden 19004* (A, MO); Hunder and Paterson Rivers, *Brown* in 1802–5 (MEL), *Brown 3117* (TYPE, †BM); Ourimbah, *Laserson 435* (†A); Illawarra Distr., near Bulli, *Kirton 8* (MEL), *Anon. 152* (BRI); *Anon.* (MEL). LOCALITY UNKNOWN: Dundowran, Nichenbach, Sandy Flat, *Tryon* in 1928 (BRI); Bennett's River, *Leichhardt* in 1943 (MEL); Ash Island, *Leichhardt* s.n. (MEL). Tasmania: Van Diemen's Land, *Caley* in 1805 (†BM).

Cultivated. AUSTRALIA. Queensland: Brisbane Botanic Garden, *White 2337* (A, BRI), *Everist 75* (MO). New South Wales: Sydney, The Domain, *Boyce 19005* (A, MO, UC), Botanic Garden, *Camfield* in 1896, 2 sheets, ♂ and ♀ (†UC), *Eames* s.n. (CU). ASIA: Nepal (?), Villa Thuret, *Martio* in 1889 (A), *Wallich* s.n. (†P); Singapore, *Scheidweiler* s.n. (†BR). AFRICA: Tunis, *Anon.* in 1868 (†MO, 2 sheets), *Anon.* in 1870 (†MO); Natal, behind Durham Botanic Garden, *Wilson* in 1922 (†A); Cape Colony, Capetown State Nursery, *Bowman* in 1921 (†A). EUROPE: Italy, Rome, Mont. Pinario, *Anon.* in 1869 (†MO); England, Kew, Royal Botanic Garden, *Cook* in 1937 (†ILL) *Anon.* in 1832 (†BR). SOUTH AMERICA: Brazil, Rio de Janeiro Botanic Garden, *Curran 341* (†US); Chile, Valparaiso, Los Zooras, Jardin Suizo, *Harshberger 1031* (PENN, †US); site unknown, *Anon. s.n.* (PH). NORTH AMERICA. United States. New York: New York Botanical Garden, 3740 ex DPM in 1900, *Nash* in 1905 (†NY), *Hartling* in 1919 (†NY), 3750 ex DPM in 1900, *Nash* in 1905 (†NY), 4788 ex DPM in 1900, *Taylor* in 1906 (†NY), 8766 ex MBG in 1901, *Nash* in 1901 (†NY), 11800 ex DPB in 1902, *Taylor* in 1905 (NY), 14415 ex Edinburgh in 1902, *Taylor* in 1905 (NY); Manhattan, Dept. of Parks 3740, *Hartling* in 1900 (†ILL). New Jersey: cult. in greenhouse from CU56 from Atkins Garden, Cuba, *Johnson* in 1952 (RUT). District of Columbia: Washington, *Foxworthy* in 1903 (†CU, NY), *Anon. s.n.* (ILL). California: Stanford University, *Dudley* in 1909 (†DS); San Francisco, Golden Gate State Park, *Walther* in 1936 (CAS), *Buchholz* in 1942 (†ILL); Mill Brae, Mills' Place, *Walther* in 1921 (CAS); Berkeley, *Eastwood* in 1913 (CAS), *Curran 23* (A); Goleta, Sexton's place near Santa Barbara, *Eastwood* in 1917 (†CAS), *Van Rensselaer 1716* (ILL), *Buchholz* in 1941 (†ILL); Santa Barbara, *Eastwood* in 1926 (A, †CAS); Hueneme, Bord's place (Ventura Co.), *Walther* in 1921 (CAS), *Vijos* in 1917 (CAS); San Diego, *Wongenheim* in 1941 (ILL); Jefferson's, *Walther* in 1926 (CAS), *Wilson* in 1937 (CAS), Hawaiian Islands: Oahu, *Curran 122* (†US).

Podocarpus elatus is not represented in our herbaria by many specimens collected directly from native habitats in Australia, but there are a large number of specimens from cultivation both here and abroad. The cultivated specimens have masqueraded under a number of different names: *P. macrophyllus* (China), *P. neriifolius* (Nepal), *P. coriaceus* (West Indies), *P. polystachyus* (Singapore), *P. latifolius* (Africa), *P. purdieanus* (Jamaica) and *P. spinulosus* (Australia). These specimens were first recognized as being identical by the striking uniformity in general appearance and by the transverse sections of the leaves (*Fig. 3*) in which the single layer of upper hypoderm and three vascular resin canals proved to be distinguishing characters. Later it was found that the broad, straight, often mucronate leaves also served to identify this plant.

An undetermined specimen collected in Tasmania by Caley in 1805

(BM) proves to be *Podocarpus elatus*. The early date of this collection precludes the possibility that this species could have been planted by Europeans and grown to a reproductive size by the time of its collection. A leaf from a specimen (P) supposedly collected by Wallich in Nepal and determined by Lindley, first as *P. macrophyllus*, later as *P. neriiifolius*, was examined. This specimen is also *P. elatus*, but it is very doubtful that this species is really to be found in Nepal. Either this specimen was picked up by Wallich en route and not given clear collection data or it has been mislabelled subsequently. Gibbs (6) lists 819 from Fiji as *P. elatus*. This is also very unlikely, as I have examined numerous specimens from Fiji and never found this species. Orr (9) included *P. elatus* in Fiji and also suggests that it is in New Caledonia and the islands of Polynesia, but it has not appeared among any specimens I have examined from these places.

Both Stiles (10) and Orr (9) examined the anatomy of the leaves of *Podocarpus elatus* and are in agreement as far as they report their observations. However, Stiles includes it with *P. polystachyus*, attributing the differences in hypoderm and auxiliary sclereids to external conditions. This does not seem to be the case since both the native collections and the large number of cultivated specimens from other climates exhibit unexpected uniformity in the leaf anatomy.

Baker and Smith (1) included photographs of the mature tree (p. 432), male cones and mature seeds on branches (p. 434), photomicrographs of transverse and longitudinal sections through the leaves (pp. 436-37) and wood and bark anatomy (p. 438).

Orr (9) stresses that the three vascular resin canals found in this species are exceptional among the Australian members of sect. *Podocarpus*. It is interesting to note that there are rare specimens in which only one vascular resin canal is developed, and also that one specimen has as many as five, two being in the transfusion tissue; however, the regular number is three. Orr observed auxiliary sclereids in the mesophyll, but I found a few in only a single specimen, *Anon.* 10545 from Mt. Spergeon. This specimen also differed from the type in the large seed, 22 mm. long and 13 mm. wide, with three distinct ridges on the back and a strong beak.

Other specimens from northern Queensland differ from the type in having long leaves (up to 18 cm.), with apices not mucronate but long-acute (*Mueller* in 1864, Rockingham Bay, and *Hartmann* in 1886, Cape York). The leaves of *Moore* 39 from Fitzroy Island are up to 30 cm. long and 22 mm. wide, thus reaching the lower limits of *Podocarpus dispermus*, but the leaves in this latter species have interrupted hypoderm. The specimen also shows five vascular resin canals, three below the vascular bundle and two in the wings of transfusion tissue, and a flat or depressed upper midrib. Its general appearance is that of a juvenile specimen.

Allen Cunningham, a well-known Australian explorer of early days, in the diary (7) of his travels mentions seeing a *Podocarpus* several times in the vicinity of Paramatta and Liverpool, very near Sydney, New South Wales. We now know that this species was *P. elatus*.

7. *Podocarpus brassii* Pilger, Engler Bot. Jahrb. 68: 246. 1938; Wasscher, Blumea 4: 469. 1941.

An erect tree, 10–12 m. tall, densely branched, with thick, stiff, verticillate, ridged branchlets. Terminal buds large, globose, the scales often spreading, rigid, ovate-lanceolate, keeled, with membranous margins, up to 8 mm. long, apex stiffly acuminate. Leaves crowded, erect to patent, thick, very stiffly coriaceous, broadly lanceolate, 1–1.8 cm. long, 3–7 mm. broad (juvenile 2.5–4 cm. long), the apex acute or obtusely apiculate, narrowing at base to a short broad petiole, shiny above, duller beneath with the exception of a broad marginal band; margins revolute; midrib narrow and prominent or scarcely prominent above, broader below. Transverse sections of the leaves show three (rarely one) vascular resin canals, upper hypoderm of scattered fibers, rare isolated lower hypodermal fibers between the stomatal rows, rare vascular sclereids and no auxiliary sclereids. Leaves quite thick with more than one layer of palisade mesophyll. Pollen cones axillary, solitary, sessile, surrounded at the base by ovate-triangular scales, cylindric, 2.5–3 cm. long, 3–7 mm. thick. Microsporophylls densely imbricate, each with long triangular acute apiculus. Female cones solitary in upper leaf axils; peduncles thick, 2–9 mm. long; receptacle of 2–3 fused fleshy scales, 5–9 mm. long, 2.5–7 mm. broad, subtended by 2 narrowly triangular bracts, 3 mm. long; ovule usually solitary. Seeds elliptical-globose, rounded at the base and apex, 7–10 mm. long, 5–6 mm. broad.

DISTRIBUTION: High mountains, above 3000 m. altitude, New Guinea.

New Guinea. NETHERLANDS NEW GUINEA: Lake Habbema, 3225 m. Camp, *Brass* 9341 (†A), 9342 (†A), 9560 (†LAE), *Brass & Meyer-Drees* 10435 (A), 10436 (A). TERRITORY OF NEW GUINEA. Eastern Highlands District: Mt. Wilhelm, Lake Piunde, *Womersley* 8866 (LAE). PAPUA. Central Division: Mt. Albert Edward, *Brass* 4295 (ISOTYPE, †A–2 sheets; †BRI), *Brass* 4395a (BRI), *Brass* 4396 (BRI).

The leaves of *Podocarpus brassii* are smaller than those of *P. brevifolius*, which are usually over 2 cm. long. It also differs from *P. glaucus* in that its young foliage is not glaucous and the pollen cones are thick instead of slender. Orr (9) agrees with the above description of the leaf anatomy. I have observed that the upper hypodermal fibers are larger in *Brass* 9342 than *Brass* 4395.

8. *Podocarpus glaucus* Foxworthy, Philipp. Jour. Sci. 2: 258. 1907, 6: 159. 1911; Pilger, Nat. Pflanzenfam. ed. 2. 13: 248. 1926; Florin, Svenska Vet.-Akad. Handl. III. 10: 262, 266. 1931; Wasscher, Blumea 4: 468. 1941.

A small bushy tree, 5–6 m. tall, with branchlets crowded toward tips of branches, light colored. Terminal buds very small, the outer scales spreading, up to 2 mm. long, with acuminate apex. Leaves densely crowded, erect-patent, coriaceous, glossy, pale beneath and glaucous when young, oblong, elliptic-oblong or spatulate, 0.9–1.7 cm. long, 3.5–5.5 mm. wide,

apex obtuse or rounded, the base gradually narrowed to 1–2 mm. petiole and somewhat decurrent; margins thickened; midrib prominent near base on upper side, becoming flat and indistinct toward the apex, very prominent beneath. Transverse sections of the leaves show three resin canals below the vascular bundle, upper hypodermal fibers large and scattered, no lower hypodermal fibers between the stomatal rows, no vascular fibers nor auxiliary sclereids. Pollen cones solitary in upper leaf axils, scattered, slender cylindrical, 1–1.5 cm. long, 2–3 mm. thick. Microsporophylls densely imbricate. Female cones and seeds not known.

DISTRIBUTION: Mt. Halcon, 2400 m. altitude, on Mindoro in the Philippine Islands and the slopes and summit of Mt. Moetaro in New Guinea.

Philippine Islands: MINDORO: Mt. Halcon, *Merrill 5672* (†ex Florin, Berlin Herbarium). Netherlands New Guinea: Wissel Lake region, Mt. Moetaro, *Eyma 5208* (†A).

Podocarpus glaucus is a little-known species and its position in the genus has been doubtful until the present time. The examination of the transverse sections of the leaves shows three resin canals under the phloem of the vascular bundle, transfusion tissue, accessory transfusion tissue, and hypodermal fibers on both sides of the leaf. These characters definitely place it in subsection B of section *Podocarpus*; it seems to be most closely related to *P. brevifolius*, which has larger leaves with parallel margins, and *P. brassii*, which has very thick pollen cones.

Florin (4) listed *Podocarpus glaucus* as a hypostomatic species of section *Stachycarpus*. The solitary pollen cones and the leaf anatomy show that it could not belong to this section. Wasscher (11) concluded correctly that it belongs in section *Podocarpus*, but he did not see *Merrill 5672*, the specimen on which the species is based. *Clemens 32032* and *40001*, which he lists, have continuous upper hypoderm and belong elsewhere, invalidating his description for this species. I have not seen the other two specimens which he lists, but I do not believe that *P. glaucus* has yet been collected in Borneo.

Orr (9) followed Florin in including *Podocarpus glaucus* in section *Stachycarpus* and he described the leaf anatomy correctly, but unaccountably treated the species along with *P. amarus* and *P. rostratus* as aberrant species in this group. His suggestion that the three species comprise a separate group is not tenable as they differ greatly from each other and each species must have separate consideration. By not placing this species in section *Podocarpus* with others from the Pacific islands, he missed seeing its similarity to *P. brassii* and *P. brevifolius*.

9. *Podocarpus brevifolius* Foxworthy, Philipp. Jour. Sci. 6: 160. 1911; Pilger, Bot. Jahrb. 54: 40. 1916; Florin, Svenska Vet.-Akad. Handl. III. 10: 279. 1931; Wasscher, Blumea 4: 466. 1941; Metcalf, Fl. Fukien 1: 21. 1942.

P. neriifolius var. *brevifolius* Stapf, Trans. Linn. Soc. Bot. II. 4: 249. 1894; Pilger, Pflanzenreich IV. 5(Heft 18): 93. 1903.

P. wangii C. C. Chang, Sunyatsenia 6: 26. 1941; Metcalf, Fl. Fukien 1: 21. 1942.

A small tree or shrub with verticillate, spreading, stout branchlets. Terminal buds small, 2.5 mm. wide, with outer scales keeled, 3–7 mm. long, tardily deciduous, the tips acute to long-acuminate sometimes spreading. Leaves densely crowded, erect, thick-coriaceous, rigid, quite flat, straight or slightly falcate, elliptic to lanceolate, sessile or subsessile, 1.5–5.5 cm. long, 4–6 mm. wide, shining above, duller beneath, apex acute or somewhat rounded; upper midrib prominent and narrow, broader below; margins flat or revolute. Transverse sections of the leaves show three vascular resin canals below the phloem (rarely only one), interrupted upper hypoderm of small or often quite large fibers, no hypodermal fibers between the stomatal rows below, no auxiliary sclereids and no vascular fibers above the xylem, rarely below the phloem. Male cones solitary in the upper leaf axils, sessile, cylindrical, thick, 2–3 cm. long, 4–5.5 mm. in diameter, scales at the base triangular. Microsporophylls imbricate, triangular, with obtuse apiculus. Female cones solitary, axillary near the tip of the branchlet; peduncles 2–4 mm. long, broad and flattened; receptacle of two fused fleshy scales, free at the tips, subcylindrical, 5–6.5 mm. long, 2.5–4 mm. thick, subtended by a pair of subulate to narrow-triangular, keeled, acute bracts, 3–5 mm. long. Seed ovoid, 1.2 cm. long, apex obtuse.

DISTRIBUTION: High mountain slopes in the Philippine Islands, on Mt. Kinabalu in British North Borneo and on Hainan island.

Philippine Islands. LUZON: Zambales, Bur. Sci. 5002, Ramos (A, NY), For. Bur. 9511, Curran & Merritt (†MO, NY, †US). **Hainan.** Wang 36533 (A, NY). **British North Borneo.** Mt. Kinabalu: Paka Cave to Low's Peak, Clemens 10657 (A, GH, †UC); upper Kinabalu, Clemens 27825–27103 (†NY); above Paka, Clemens 28901 (A, †NY); Gurulau Spur, Clemens 50825 (A, †UC); Penibukan, Clemens in 1933 (A, NY, UC).

Podocarpus brevifolius was first described as a variety of *P. neriifolius* by Stapf from an early collection from Mt. Kinabalu. He included it under this species only because Hooker had combined *P. neriifolius* and *P. polystachyus* and he believed it to be more closely related to the latter. Foxworthy (5) suggested that it is more closely related to *P. pilgeri*, with which I would agree. According to Wasscher (11), it is "a very distinct species in its adpressed, small, lanceolate, thick-coriaceous leaves."

This examination of a number of specimens of *Podocarpus brevifolius* shows that the layer of upper hypodermal fibers is always interrupted. I believe that Orr (9), who is not in agreement with this, examined only Clemens 32021 from the British Museum since his description fits this specimen perfectly. It is here included in the new species, *P. gibbsii*.

Metcalf (8) who lists this taxon from China, assigns to it three specimens: Wang 36533 from Hainan and Wang 39578 and 40196 from Kwangsi. I agree on the specimen from Hainan but I question the two from Kwangsi on the mainland as I have not seen them and they may be *Podocarpus macrophyllus* var. *chingii*.

10. *Podocarpus spinulosus* (Smith) R. Brown ex Mirb. Geogr. Conif. in Mém. Mus. 13: 75. 1825; Endlicher, Syn. Conif. 213. 1847; Carrière, Traité Conif. 653. 1867 (in part); Parlatores in DC. Prodr. 16: 513. 1868; Bentham, Fl. Austral. 6: 247. 1873; Mahlert, Bot. Centralbl. 24: 281. 1885; Pilger, Pflanzenreich IV. 5 (Heft 18): 78. 1903, Nat. Pflanzenfam. ed. 2. 13: 247. 1926; Brooks & Stiles, Ann. Bot. 24: 305. 1910; Baker & Smith, Res. Pines Austr. 443. 1910; Dallimore & Jackson, Handb. Conif. 56. 1931, 81. 1948; Florin, Svenska Vet.-Akad. Handl. III. 10: 280. 1931.

P. bidwillii Hoibrenk ex Endlicher, Syn. Conif. 213. 1847.

P. excelsa Loddiges ex Endlicher, Syn. Conif. 213. 1847.

P. pungens Don ex Lamb. Pinus, ed. 1. 2: 21. 1824; ed. 2. 2: 124. 1828.

Nageia spinulosa F. Müll. Cens. 109. 1882.

Taxus spinulosa Smith in Rees Cyclop. 35. 1819.

A small tree, sometimes shrublike, with scattered or subverticillate branches. Terminal buds small, ovate with erect triangular, narrowly acuminate or attenuate scales up to 8 mm. long. Leaves scattered, coriaceous, erect to patent, linear, subsessile, 2–6.5 cm. long, 2–4.5 mm. wide, shiny above, apex long-acuminate and often pungent, base tapering abruptly to a very short petiole, or sessile; midrib narrow and evident above, broader and less prominent below. Transverse sections of the leaves show only one vascular resin canal, interrupted upper hypoderm often scarce between margin and midrib, no hypodermal fibers between the stomatal rows below, often two layers of palisade parenchyma, and regular transfusion tissue, upper vascular fibers rare. Male cones often very abundant, solitary or in clusters of 3–5 at the tips of very short, 1–3 mm., axillary peduncles subtended by 5–6 mm. long bracts, apiculate, simulating leaves; each cylindrical cone, 4–8 mm. long, surrounded at the base by a few stiff scales. Microsporophylls densely imbricate, obtuse, apiculate. Female cones axillary to prophylls or true leaves in basal part of young shoot; peduncle slender, up to 1 cm. long; receptacle of 2–3 fused fleshy unequal scales, free at the tips, subtended by 2 subulate bracts 1–4 mm. long, glaucous, deep purple and edible when mature, bearing one ovule. Seed broadly ovoid, 1–2 cm. long, 7–10 mm. wide, often with a stout beak.

DISTRIBUTION: In light forest, usually in sandy soil; southeastern New South Wales near Sydney.

Australia. NEW SOUTH WALES: Sydney, *Anon. s.n.* (†CAS), *Anon.* in 1897 (A), *Anderson 34* (NY), *Wright* in 1853–56 (NY, Y), *Prajerus* in 1889 (MTMG), *Kenny s.n.* (BRI–2 sheets); Port Jackson, *Mueller* in 1855 (MEL), Manly Beach, *Dawson s.n.* (MEL); Lake Narrabeen, beyond Manly, Wheeler's place, *Maiden* in 1887 (MEL); Paramatta, North Rocks, *Anon. s.n.* (MEL); Loftus, *Camfield* in 1897 (†MO); Collaree, *Burges* in 1930 (NY); Mosman, *Cannon 443* (A); Blackdown Tableland, *Simmons 76* (BRI); Lake Tabourie, *Baker* in 1892 (BRI); Beerwah, *White 12858* (BRI–2 sheets, ♂ and ♀); *R. Brown* in 1802–5 (†E); Jervis Bay, Naval Reserve, *Willis* in 1954 (MEL). STRADBROOKE ISLAND: *White 1665* (BRI); *White 1708* (A, BRI). Locality unknown: *Anon. s.n.* (BRI).

Podocarpus spinulosus resembles *P. drouynianus* in having long, slender crowded leaves, but in *P. spinulosus* the leaves taper to a definite short petiole and the midrib is prominent. In the transverse sections of the leaves the cuticle is a little thinner, the accessory transfusion tissue is more regular and the palisade layer is thicker. Orr (9) agrees with the description of the leaf anatomy and the specimen, *R. Brown* in 1802–05 (E), is probably a duplicate of the one he used.

11. *Podocarpus drouynianus* F. Müller, *Fragm.* 4: 86, *t.* 31. 1863–64; Bentham, *Fl. Austral.* 6: 274. 1873; Bertrand, *Ann. Sci. Nat.* V. 20: 64. 1874; Van Tieghem, *Bull. Soc. Bot. France* 38: 169. 1891; Pilger, *Pflanzenreich* IV. 5(Heft 18): 77. 1903, *Nat. Pflanzenfam.* ed. 2. 13: 247. 1926; Baker & Smith, *Res. Pines Austral.* 443. 1910; Dalimore & Jackson, *Handb. Conif.* 48. 1931, 66. 1948; Florin, *Svenska Vet.-Akad. Handl.* III. 10: 279. 1931.

P. brownii Bertrand, *Ann. Sci. Nat.* V. 20: 64. 1874 (nomen).

Nageia drouyniana F. Müll. *Cens.* 104. 1882.

A small tree or shrub, 1 m. high, with erect branches. Terminal buds ovate, with narrow, acute or attenuate scales up to 5 mm. long. Leaves spirally arranged, erect to patent, thin, leathery, linear, straight, subsessile, 2–12 cm. long, 2–5 mm. broad, green above, glaucous beneath, apex acute-acuminate, rarely pungent, short angustate at the base; margins somewhat revolute and thickened; midrib scarcely prominent or flat above, broad and prominent beneath. Transverse sections of the leaves with only one resin canal below the vascular bundle, the upper hypoderm interrupted, no hypodermal fibers between the stomatal rows, often very little transfusion tissue, accessory transfusion tissue usually of very irregularly elongate cells which are quite thick, vascular fibers very abundant below the phloem and forming a tissue several cells thick; cutin very thick and rounded over each epidermal cell; epidermis of very large cells, up to 207 μ long and 11–46 μ wide, pitted, with somewhat wavy walls. Pollen cones solitary or clustered at the ends of slender axillary peduncles 1–2.5 cm. long, or widely scattered, up to six on special axillary branches, each cone on a separate peduncle with a subulate bract at the base, sometimes with sterile bracts; mature cones short, thick, cylindrical, 4–10 mm. long, 4 mm. wide. Microsporophylls densely imbricate, minutely apiculate. Female cones solitary in the axils of prophylls or the lowermost true leaves of new growth; peduncles variable, up to 2.0 cm. long; receptacle of 2 or 3 fleshy fused unequal scales with the tips free, 2.5 cm. long, subtended by 2 narrow bracts 2–3 mm. or more long, sometimes foliaceous and unequal (up to 11 mm. long, 2 mm. wide on *Gilbert* 45), waxy-coated, purple at maturity, sometimes bearing 2 ovules when young but only one maturing. Seeds broadly ovoid, 1–1.7 cm. or more long, not crested.

Australia. WESTERN AUSTRALIA: Busselton, *Pries* in 1870 (MEL); Warren Dist., Manjimup, *Koch* 2499 (BRI, MEL, †MO), Warren River, *Mueller* in 1877 (MEL); Tom River, *Mueller* s.n. (MEL); Dape River, *Oldfield* s.n. (MEL); Preston Gor-

don River, *Mueller* in 1877 (MEL); Greenbushes, *Cook* in 1939 (MEL); Bow River, *Jackson* in 1912 (BRI); Blackwell River, *Mueller* s.n. (PH); Fly River, *Wilson* 263 (†A); Vasse River, *Dept. Agr.* in 1898 (A); Denmark, Jarrah Forest, *White* 5377 (A, BRI, †NY), *Dept. Agr.* 443 (†A); southwest, *Eames* in 1937 (CU); *Baker* in 1904 (†A); *Gilbert* 45 (†BM, MO); *Drummond* 154 (MEL).

Podocarpus drouynianus has grass-like leaves which differ from those of *P. spinulosus* in having broad bases and in being sessile or very nearly so. The upper surface of the leaf is nearly flat at the midrib. The leaf anatomy differs little except for the very thick cuticle and the loose construction of the accessory transfusion tissue.

Orr (9) examined the leaf anatomy of this species and reported the single vascular resin canal; the thick cutin was also a distinguishing character.

Mueller in 1877 (MEL) from the Warren River is an excellent example of the reduction from normal vegetative leaves to the scale-like prophylls of the reproductive portion of the stem. The specimen twig is about 45 cm. long and the basal portion, 5–6 cm. long, is bare, the old leaves having fallen away. The next 20 cm. bears short, 2.5 cm. long, spreading leaves which decrease upward to narrow triangular scales 5 mm. long with spreading tips. In the following 10 cm. the prophylls are up to 8 mm. long and in the axils are solitary peduncled fruit. The remaining 14 cm. has large linear, mucronate leaves, 4–7 cm. long and 2–3 mm. wide, terminating in a bud which has just burst with new growth without having yet elongated.

12. *Podocarpus affinis* Seem. Fl. Vitiens. 266. 1865–73; Parlatores in DC. Prodr. 16: 517. 1868; Warburg, Monsunia 1: 193. 1900; Pilger, Pflanzenreich IV. 5 (Heft 18): 78. 1903, Nat. Pflanzenfam. ed. 2. 13: 248. 1926; Florin, Svenska Vet.-Akad. Handl. III. 10: 279. 1931; Dallimore & Jackson, Handb. Conif. 38. 1931, 60. 1948.

A tree with short, spreading branchlets, densely leafy toward the tips. Leaves spirally arranged, patent, linear-elliptic, 3–5.2 cm. long, 6–9.5 mm. wide, reddish-brown underneath when dry (young leaves glaucous), the apex obtuse with pointed tip, the base narrowed into a short distinct petiole; midrib narrow and often very prominent above, narrow and sometimes with shallow grooves on either side below. Transverse sections of the leaves show three vascular resin canals with vascular fibers usually present both above and below the bundle, an interrupted hypoderm of fibers 18–30 μ in diameter, usually quite abundant on the upper side, but very rare on the lower between the stomatal rows, auxiliary sclereids in the mesophyll between the palisade mesophyll and the accessory transfusion tissue and also a few in the palisade making that layer discontinuous, palisade tissue occasionally doubled in thicker leaves, the cuticle sometimes thick. Male and female cones unknown.

Fiji. VITI LEVU: Namosi, Voma Peak, *Seemann* 574 (TYPE, †BM, †GH, K), *Gillespie* 2721 (†UC), *Horne* 769 (K), 973 (†GH, K).

Orr (9) examined the leaf anatomy of *Podocarpus affinis* and his account

agrees with the above description. The short leaves distinguish this species from the others in Fiji but only the vegetative characters are known.

13. *Podocarpus sylvestris* Buchholz, Bull. Mus. Paris II. 21: 285. 1949.

A tree becoming 15–18 m. high with the trunk up to 2 m. in diameter; outer bark gray and furrowed between longitudinal plates, the inner bark reddish brown; twigs very slender, subverticillate. Vegetative buds spherical or ovoid, solitary or in groups of three, with thin, slightly carinate, ovate, apiculate or obtuse, appressed scales. Leaves aggregated toward the ends of twigs, linear-lanceolate, 5–9 cm. long, 7–9.5 mm. wide (sometimes up to 17 cm. long and 15.5 mm. wide), narrowed above to an obtusely rounded apex, narrowed at the base to a short petiole, bright shiny green becoming gray-green above, lighter dull green beneath; midrib flat on both surfaces or broadly prominent. Transverse sections of the leaves show 3 vascular resin canals, hypoderm interrupted above with small fibers rarely more than 20 μ in diameter, few and scattered fibers between the stomatal rows below, vascular sclereids usually above and sometimes below, auxiliary sclereids present in the palisade mesophyll and abundant in the mesophyll above the accessory transfusion tissue. Pollen cones axillary, in clusters of 3, sessile or the peduncle 1 mm. long, cylindrical, 8–16 mm. long, 2–2.5 mm. in diameter when fully expanded; surrounded at base by 7–9 thin imbricated bud scales, the outer acute, the inner obtuse. Microsporophylls with a scarious obtuse apiculus. Female cones axillary on slender peduncles 5–9 mm. long; receptacle of 2 fused fleshy unequal scales 6–7 mm. long, subtended by a pair of small deciduous bracts and bearing a single ovule. Seed elongated, becoming 13 mm. long and 8–9 mm. wide, with only a minute or suppressed crest.

DISTRIBUTION: Scattered in mixed angiosperm forests of southern New Caledonia at 150–400 m. altitude.

New Caledonia: Plaine des Lacs, foret du Mois de Mai, *Buchholz 1696* (TYPE, †ILL, P), *1351* ♂ (†ILL, P), *1352* ♀ (†ILL, P), *1354* (†ILL), *1360*, *1372* — juvenile (ILL, P) *1392* (ILL), *Bernier 158* (P), *219* (P), *Bernier* in 1947 (ILL); Baie des Pirogues, *White 2118* (†A, BRI, P), *White s.n.* (K-2 sheets); north of St. Louis, Thy River, *Buchholz 1233* (†ILL); Mt. Canala, *Compton 1273* (†BM); North Prony, *Cribs 4718* (†P); Mt. Balade, *Vieillard 1265* (A, P); Wayap, *Vieillard 1265* (P); Pic du Pin, *Virots 598* (A); Mont Mi, *Virots 735* (A). Locality unknown: *Kay 34* (†P), *Vieillard 1265* (P).

It is likely that *Podocarpus sylvestris* has been confused in the past with *P. longifoliolatus* Pilger in subsection F, a tree which occurs on Mt. Mou in high coniferous rain-forests above 1000 m. It differs from the latter in its more slender twigs and globose vegetative buds with closely appressed ovate or obtuse, apiculate scales. Transverse sections of the leaves show only three vascular resin canals and smaller hypodermal fibers. *Podocarpus longifoliolatus* has, in addition, two or more resin canals above the vascular bundle. The female cones of *P. sylvestris* bear solitary ovules.

According to the manuscript notes of Prof. Buchholz, the vegetative buds of this species are more like those of *P. novae-caledoniae*. It differs from the latter in the much wider leaves with interrupted hypoderm. *Podocarpus novae-caledoniae* is the only other species in New Caledonia belonging in this subsection and its shrubby habit distinguishes it readily.

The wood is light, reddish, of excellent quality and is used for lumber. It is called "False Kauri" where it is marketed. One specimen, *Buchholz 1392*, has white wood but does not seem to differ otherwise.

14. *Podocarpus idenburgensis*, sp. nov.

Arbor 12–33 m. alta; ramulis tenuibus gemmis terminalibus parvis, ovatis vel globosis; foliis apice ramulorum congestis, lineari-lanceolatis vel lineari-ellipticis, 8–15 cm. longis et 9–15 mm. latis, apicibus acutis, petiolis 6–10 mm. longis, strobilis masculis alabastris axillaris cicatricorum foliorum oppositis positus, pedunculo tenue, 3–12 mm. longo, strobilis maturis 4 cm. longis, 5 mm. crassis; strobilis foemineis solitariis, pedunculo tenue, 8 mm. longo; semine globoso, 9 mm. longo, apice tenue rotundato.

A tree 31–57 cm. in diameter, the outer scales of the terminal buds on the twigs narrowly triangular, erect or spreading, up to 6 mm. long, the tips long acute or acuminate. Leaves straight or falcate, coriaceous, gradually or more abruptly narrowing to a definite petiole and gradually narrowing to an acute apex; midrib usually narrowly prominent above, almost flat below. Male cone bud scales acutely triangular, erect; microsporophylls imbricate, tips broadly obtuse, scarious, somewhat erose. Female cones axillary; receptacle very fleshy of 3 fused scales almost 1 cm. long.

DISTRIBUTION: In high mountain rain-forests in Netherlands New Guinea.

New Guinea. NETHERLANDS NEW GUINEA: 6 km. SW of Bernhard Camp, Idenburg River, *Brass & Versteegh 12581* (TYPE, †LAE); 2 km. SW of Bernhard Camp, Idenburg River, *Brass & Versteegh 13530* (†A, LAE); Bele River, 18 km. NE of Lake Habbema, *Brass & Versteegh 11133* (†A, LAE).

This species must be distinguished from both *Podocarpus neriifolius* and *P. rumphii* in New Guinea. It differs from these species in its large male cones, usually solitary or rarely paired, on peduncles up to 12 mm. long. The shape of the leaves is like that of both of the other species, while the terminal buds are more like those of *P. neriifolius*. Transverse sections of the leaves did not show any auxiliary sclereids and there were no lower hypodermal fibers in *Brass & Versteegh 11133*.

The name refers to the Idenburg River which flows adjacent to the region in which the species is found most abundantly.

15. *Podocarpus ledermannii* Pilger, Bot. Jahrb. 54: 210. 1916, Nat. Pflanzenfam. ed. 2. 13: 248. 1926; Florin, Svenska Vet.-Akad. Handl. III. 10: 279, 283. 1931; Wasscher, Blumea 4: 456. 1941.

A tree up to 20 m. high with gray bark and slender spreading branch-

lets; terminal buds small and ovate with long-triangular apiculate bud scales. Leaves scattered or crowded at the tips of the branches, thinly coriaceous, flexible, elliptic-lanceolate or narrow-elliptic, broadly cuneate or cuneate-rounded at the base, obtuse or abruptly narrowed and acute at the apex, often almost caudate at the tip, scarcely shiny above, dull below, 8–12 cm. long, 12–27 mm. wide; midrib abruptly prominent above, broader below. Transverse sections of the leaves show 3 vascular resin canals, interrupted hypoderm of large scattered or isolated fibers, some hypodermal fibers scattered below between the stomatal rows, vascular sclereids both above and below the bundle, auxiliary sclereids in the mesophyll both above and below the accessory transfusion tissue. Pollen cone buds in groups of 2 or 3 on very short peduncles; scales ovate-triangular, acute, keeled, 2 mm. long, inner ones more obtuse. Microsporophylls ovate-triangular obtuse or with acute apiculus. Female cones solitary, axillary, on peduncles 6.5–9 mm. long; receptacle of 2 or 3 fused fleshy scales with free tips, subtended by 2 subulate bracts 2.5 mm. long. Seed elliptic or globose, about 8 mm. long, crested.

DISTRIBUTION: In mountain forests of New Guinea, Java and Borneo.

New Guinea. NETHERLANDS NEW GUINEA: Bele River, 18 km. NE of Lake Habbema, *Brass 11058* (†A); Idenburgh River, 6 km. SW of Bernhard Camp, *Brass 12749* (†A). TERRITORY OF NEW GUINEA. Sepik District: Lordberg, *Ledermann s.n.*, ex Berlin Herbarium (†ex Florin). Eastern Highlands District: Chimbu, *Cavanaugh NGF3336* (†LAE). Morobo District: Yungaing, *Clemens 2352* (†A). **Java.** *Horsfield s.n.* (†GH); Preanger, *Warburg 2678* (†NY). **Borneo.** SARAWAK: *Foxworthy 377* (†US); Mt. Poi, *Clemens 20348* (†A, NY).

Podocarpus ledermannii differs from *P. neriiifolius* in the more oval or oblong shape of the leaves and from *P. rumphii* in its abruptly or narrowly prominent midrib. Transverse sections of the leaves differ from *P. neriiifolius* and *P. rumphii* in the large hypodermal fibers, hypodermal fibers between the stomatal rows and more abundant auxiliary sclereids. Orr (9) examined this species and found the same differences. The leaves of the specimens from Java show five vascular resin canals below the bundle and those from Borneo show three to five and there are few if any hypodermal fibers between the stomatal rows.

16. *Podocarpus dispermus* White, Contrib. Arnold Arb. 4: 10. 1933.

A small tree up to 17 m. high with light brownish-gray, slightly flaky bark. Vegetative buds small; the scales narrow, acute, stiff and erect, up to 6 mm. long, longer than bud. Leaves dark glossy green, straight, broad-linear or narrow-lanceolate, apex acute, often pungent, gradually narrowing at base to a short petiole, 10–20 cm. long, 20–30 mm. wide; midrib broadly prominent above and below. Transverse sections of the leaves show usually 3 vascular resin canals (rarely one or five), an interrupted upper hypoderm of fibers 18–33 μ in diameter, lower hypodermal fibers between the stomatal rows, vascular sclereids present above and below,

and auxiliary sclereids absent in palisade and spongy mesophyll. Pollen cones sessile, in clusters of 1–3, 3 cm. long, 3 mm. broad, surrounded by acute scales at the base. Microsporophylls crowded, imbricate, with the apiculus short, broad, and acute. Female cones axillary, on thick peduncles 5–15 mm. long; the very fleshy receptacle subtended by two small deciduous scales, turning scarlet when the fruit is ripe. Seeds usually in pairs, ellipsoid, 2.5 cm. long, 1.7 cm. broad.

DISTRIBUTION: In rain forests in northeast Queensland.

Australia. QUEENSLAND: Atherton Tableland, Gadgarra Reserve, *Kajewski 1192* (TYPE, †A, BRI, ILL, NY), *Kajewski 1107* (†A, BRI, NY–3 sheets); Millea Millea, *Tardent* in 1930 (A, BRI); Johnstone River, *Michael 97* (BRI).

Podocarpus dispermus differs from *P. elatus* in having broader and usually longer leaves with interrupted hypoderm. The receptacle and seeds are larger and the ripe receptacle of *P. dispermus* is red instead of blue-black. This species is not very abundant and has a restricted range in the region of Atherton in northern Queensland. Orr (9) did not see any specimens of *P. dispermus*, but he correctly included it in section *Podocarpus*.

The pollen cones on *Michael 97* are on short (1.5 cm.) branches arising from stems more than one year old, which also bear leaves. This is the only specimen I have seen with pollen cones.

17. *Podocarpus salomoniensis* Wasscher, *Blumea* 4: 430. 1941.

Tree up to 20 m. tall with pale yellowish-brown, thin bark, usually smooth but sometimes fissured and flaking, the scattered drooping branches with stout twigs. Terminal buds large, ovoid, with long-attenuate scales up to 11 mm. long, the outer spreading and keeled, the inner erect. Leaves spirally arranged, spreading or crowded, linear to linear-lanceolate, sometimes falcate, 12–18 cm. long, 6.5–9 mm. wide, shiny above, dull beneath, long-tapering to an acuminate apex or sharp point, very gradually narrowed at base to a short, more or less distinct petiole; midrib sharply prominent above (in dried leaves sometimes located in a broad channel or fold), broader below; margins revolute. Transverse sections of the leaves usually show five vascular resin canals, the outer two of which are commonly found in the transfusion tissue, interrupted upper hypoderm of small fibers, lower hypodermal fibers absent between stomatal rows, vascular fibers above but not below the midvein, auxiliary sclereids in the mesophyll usually quite rare. Pollen cone buds solitary in the axils of upper leaves of new growth, large, 4–5 mm. diameter, connate; scales broadly triangular, apex acute, as long as bud. Female cones solitary in the leaf axils; peduncles divaricate, 11–15 mm. long; receptacle fleshy, 8–9 mm. long, of four decussate bracts, of which only the two lower are fertile, subtended by two narrow bracts, 4 mm. long, just beneath its base. Seed elongated, rounded at the apex and somewhat narrowed toward the base, 11 mm. long, 8 mm. broad.

DISTRIBUTION: On slopes in rain forests at 400–900 m. altitude in the Solomon Islands.

Solomon Islands. SAN CRISTOBAL ISLAND: Hinuahaoro, *Brass* 2881 (TYPE, BM, BRI, †ex Florin, Leiden Herbarium); Waimasi River, *Walker BSIP*. 254 (A, BRI, †K).

Podocarpus salomoniensis is quite distinct from *P. neriifolius* which is also found in the Solomon Islands. It has long, much narrower leaves which are usually quite crowded, the receptacle has four fleshy scales instead of two and the bracts are very close to its base. Transverse sections of the leaves show five vascular resin canals. Wasscher (11) recognized a relationship between *P. deflexus* Ridley and *P. salomoniensis* in the leaf and fruit, but he distinguished the latter by its "non-deflexed leaves, with the midrib usually not channelled beneath." In the leaf transverse sections I find these species similar, except for the smaller hypodermal fibers, 10–26 μ in diameter, in *P. salomoniensis*.

18. *Podocarpus deflexus* Ridley, *Fl. Malay Peninsula* 5: 283. 1925; Florin, *Svenska Vet.-Akad. Handl.* III. 10: 279. 1931; Wasscher, *Blumea* 4: 427. 1941.

A small tree, 5–8 m. tall, the divaricate branches with stout branchlets showing numerous leaf scars. Terminal buds large, globose, with the outer scales narrow-triangular and reflexed, the inner scales almost triangular and adpressed. Leaves densely crowded at the ends of the branches, strongly deflexed, thick-coriaceous, rigid, linear or linear-lanceolate, 10–27 cm. long, 7–12 mm. broad, long-tapering to a shortly rounded (rarely acute) apex, gradually narrowing at the base to a very short petiole; midrib prominent above, broad and flat or deeply and broadly channelled below; margins of the blade sometimes recurved. Transverse sections of the leaves show 3–5 vascular resin canals, the center one often with the lumen closed due to the channel below and the outer pair located in the transfusion tissue; upper hypoderm of small groups of large fibers, 30–70 μ in diameter, and usually two fibers deep, no lower hypodermal fibers between the stomatal rows, vascular sclereids above and more rarely below the bundle, auxiliary sclereids in both palisade and mesophyll. Male cone buds 1–3 in the upper leaf axils, globose; mature cones unknown. Female cones solitary in the upper leaf axils; peduncle thick, 9–15 mm. long; receptacle large and fleshy, up to 8 mm. thick. Seeds obovoid, narrowed at the base, 11–12 mm. long, 8–9 mm. broad.

DISTRIBUTION: On rocky slopes, 1650–2300 m. altitude, in Gunong Tahan, Pahang.

Malay Peninsula. PAHANG: Gunong Tahan, *Ridley* 16024 (†K).

The leaves of both *Podocarpus deflexus* and *P. salomoniensis* are large, crowded, and have five vascular resin canals, but there are several striking differences. The former species has strongly deflexed leaves, which may become longer, and are twice as wide, with the midrib channelled below. In transverse section, the small groups of very large hypodermal fibers contrast with the larger groups of much smaller fibers in a neat single layer in

P. salomoniensis. *Podocarpus deflexus* differs from *P. neriifolius* in its reflexed leaves, five vascular resin canals and the large upper hypodermal fibers. These large hypodermal fibers of *P. deflexus* are most like those of *P. polystachyus* and its relatives but the latter species has only three vascular resin canals. Orr (9) also observed the interrupted upper hypoderm of large fibers of *P. deflexus*, the absence of lower hypodermal fibers and the presence of auxiliary sclereids. He apparently did not see the five vascular resin canals as he reported no such condition for any species of *Podocarpus*. Florin (4) was impressed by the thick cuticle in this species.

19. *Podocarpus annamiensis*, sp. nov.

Arbor media, 5–12 m. alta; ramulis plerumque crassis, oppositis vel verticillatis; gemmis terminalibus ovatis vel saepe globosis, 2.5–4 mm. diametro, squamis exterioribus saepe quam alabastris longis, ad 5 mm. longis; foliis apicibus ramulorum congestis, erectis vel tantum interdum divaricatis, 4–10.5 cm. longis, 5–10 mm. latis, late linearibus vel lineari-lanceolatis, apicibus abrupte angustatis, obtusis, orbiculatis vel acutis, petiolo gradatim angustato, 2–6 mm. longo, marginibus interdum revolutis; strobilis masculis ex alabastris solitariis, vel 2–3-fasciculatis, sessilibus, subglobosis, 1.5–3.0 mm. diametro, strobilis maturis ignotis; strobilis femineis solitariis, pedunculo 2–10 mm. longo; semine ovoideo inferne haud angustato, apice obtuso, apiculato vel orbiculare, 8–10 mm. longo, 6 mm. lato.

DISTRIBUTION: Frequent summit tree of mountains in the coast range of Annam and Cochin China in Indochina and nearby Hainan.

Indochina. ANNAM: Mt. Bana, *Poilane 1561* (TYPE, A–2 sheets, †P–2 sheets); Mt. Bana, 25 km. from Tourane, *Clemens 3475* (†A, NY, †P, UC); Nhatrang Prov., *Poilane 3541* (†P); Nhatrang Prov., Hoi Li, *Chevalier 38692* (†P); Quang-tri Prov., massif de Dong-co-pah, *Poilane 3541* (A). COCHIN CHINA: in cacumine montis Dink propé Baria, *Pierre 354* (A–2 sheets, NY–3 sheets); Biuh Biuh, *Pierre 354* (†P–5 sheets); Chin'a Chiang, prov. Bienhoa, *Pierre 5532* (†A, †P–2 sheets). **Burma:** site unknown, *Brandis 38* (†MEL). **Hainan:** in mountain forests, *Liang 63510* (A, †NY), *Liang 65091* (A, †NY, P), *Liang 65554* (†NY–juvenile), *Liang 65555* (NY), *C. Wang 35031* (A, NY); Ng Chi Leng, Fan Yah, *Chun & Tso 44217* (A, †NY); Lingshiu, *How 73776* (†A).

The trunks of the trees are usually 0.5–1 m. in diameter with dark brown bark. The outer scales of the terminal bud are broadly triangular, keeled, stiff, erect with apex acute and apiculate or acuminate; the inner scales are shorter with rounded or minutely apiculate apex. The leaves are usually straight but are sometimes falcate, and rarely they may be up to 18 cm. long and 20 mm. wide; the midrib is from broadly prominent to flat above, rarely narrowly prominent, and below it may be broadly prominent, flat or even channelled. The pollen cone buds are found in the axils of the lower leaves of the new growth and the bud scales are tightly appressed, broadly triangular, stiff, with obtuse to acute apices and scarious margins, strongly keeled. The young cones are greenish white. The female

cones are axillary and widely scattered; receptacle 4–8 mm. long, of two fused fleshy almost equal scales with free tips.

Podocarpus annamiensis differs from *P. neriifolius*, which is found in nearby regions, in the smaller stiff leaves which are crowded toward the ends of the twigs and in the abruptly obtuse or acute apex of these leaves. The habit and shape of the leaves is much like that of *P. macrophyllus* but it differs from this species (see no. 29) in the leaf anatomy. The stiff leaves also suggest *P. polystachyus*, but this is a tree of the strand rather than of the mountains, and the pollen cones occur in clusters of as many as five.

Transverse sections of the leaves of *Podocarpus annamiensis* show three vascular resin canals with the median one usually very small and the lateral very large and conspicuous, vascular fibers both above and below the bundle, upper hypodermal fibers 20–40 μ in diameter, very rare or in small groups and always interrupted at the midrib, hypodermal fibers absent between the stomatal rows, auxiliary sclereids in the mesophyll not abundant, cuticle thick. The two large lateral vascular resin canals distinguish transverse sections of this species from the three mentioned above. It is also distinguished from *P. macrophyllus* by the auxiliary sclereids and usually only one layer of palisade mesophyll.

The specimens listed from Annam and Cochin China are all quite similar. *Poilane 11121* with falcate narrower leaves deviates the most from the type specimen. Upper hypodermal fibers are quite rare in *Pierre 354* and abundant in *Poilane 3541*. Auxiliary sclereids have not been observed in the mesophyll of leaves from *Pierre 354*. Arnold Arboretum and New York Botanical Garden herbarium specimens of *Pierre 354* bear labels giving the site as Mt. Dink near Baria but the Paris Museum specimens give the site as Mt. Biuh Biuh.

The smaller-leaved specimens from Hainan have a more sharply acute apex to the leaves. Transverse sections of the leaves show abundant hypoderm and thick palisade which is often in more than one layer. The large-leaved specimens from the same locality have auxiliary sclereids only on the lower side of the leaf. Herbarium labels of these specimens indicate larger trees than those in Annam, reaching 16 m. in height and 3 m. in diameter.

20. *Podocarpus archboldii*, sp. nov.

Ramuli aliquando crassi, verticillati; alabastris terminalibus magnis globosis, squamis exterioribus late triangularibus ad 6 mm. longis, apicibus obtusis, recurvatis, marginibus tenuibus scariosis; foliis 3–9.5 cm. longis, 5–11 mm. latis, apicibus acutis vel acuminatis, marginibus revolutis; strobilis masculis 3–4 mm. latis; semine sphaeroideo, sine crista distincta.

A tree 6–38 m. high, 60–90 cm. in diameter with gray scaly bark 2–4 mm. thick and shallowly fissured. Leaves crowded, erect to patent, coriaceous, narrowly lanceolate, almost sessile or narrowed to a petiole 2 mm. long, green above, paler and brownish beneath; midrib narrowly prominent

above, broader below. Pollen cone buds axillary, solitary, sessile or on short 2–3 mm. peduncles, large, globose, with obtuse scales. Female cones on stout peduncles 3–14 mm. long, solitary, axillary; receptacle of several thick fleshy fused scales, 7–8 mm. long, subtended by 2 deciduous bracts 2–3 mm. long. Seeds sometimes up to 15 mm. long, 13 mm. wide.

DISTRIBUTION: Occasional trees in high primary rain-forests of New Guinea, 1820–3000 m. altitude, more common at the higher altitudes.

New Guinea. NETHERLANDS NEW GUINEA: Idenburg River, 4 km. SW of Bernhard Camp, *Brass 13121* (TYPE, ♀ †A, LAE); 15 km. SW of Bernhard Camp, *Brass 11946* (♀ †A, LAE); 18 km. SW of Bernhard Camp, *Brass 11946A* (♂ A, †LAE); 9 km. NE of Lake Habbema, 2800 m. Camp, *Brass & Versteegh 10452* (†A). TERRITORY OF NEW GUINEA. Morobe District: Samanging, *Clemens 9503* (†A), *9525* (†A), Mt. Sarawaket, *Clemens 10073* (†A). Eastern Highlands District: above Goroka, J. Leahey's logging area, *Womersley & Floyd NGF6137* (A, †LAE); Wai, High country, *Jacobs NGF53* (†LAE). PAPUA. Central Division: Wharton Range, Murray Pass, *Brass 4605* (†A, BRI), Mt. Tafa, *Brass 5118* (†NY).

In New Guinea this species is distinguished from *Podocarpus neriifolius* by smaller leaves with revolute margins and from *P. pilgeri* by larger leaves with gradually acute or acuminate tips. The large globose terminal buds distinguish it from both species.

Transverse sections of the leaves show three vascular resin canals, an interrupted upper hypoderm of fibers of medium diameter, hypodermal fibers rarely between the stomatal rows, vascular fibers both above and below the bundle, and usually no auxiliary sclereids in the mesophyll. Only *Jacobs NGF53* and *Brass & Versteegh 10452* show rare auxiliary sclereids.

Clemens indicated that his specimen *10073* from Mt. Sarawaket had red fruit. *Brass & Versteegh 10452* had a seed of larger size, 15 mm. long and 13 mm. wide.

This species is dedicated to Mr. Richard Archbold who sponsored the expedition to New Guinea on which this species was first found.

20a. *Podocarpus archboldii* var. *crassiramosus*, var. nov.

Arbor gracilis, 8–20 m. alta; ramulis crassissimis, alabastris terminalibus magnis, globosis vel globosi-ovatis, supra 5 mm. diametro; foliis congestis tenue lanceolatis, apicibus longe acutis, interdum acuminatis 6–13 cm. longis, 7–11.5 mm. latis; strobilis masculis ignotis; strobilis femineis solitariis, pedunculo 6–11 mm. longo; semine globoso-elliptico, ad 10 mm. longo et 9 mm. lato, apice rotundato vel obtuse apiculato.

Outer scales of terminal buds triangular, keeled, erect, to 9 mm. long, with long acute or acuminate tips which are sometimes recurved. Leaves divaricate, straight or falcate, gradually narrowing to short, thick petioles at the base and with long, acute tips; midrib narrowly prominent above, flat or even channelled below. Female cones axillary among lower leaves of new growth; receptacle of 2–3 fused fleshy scales with free tips, 6–8 mm. long, and subtended by 2 small subulate bracts.

DISTRIBUTION: In high mountain forests of New Guinea, 1850–2650 m. altitude.

New Guinea. NETHERLANDS NEW GUINEA: 9 km. NE of Lake Habbema, *Brass 10874* (TYPE, †A, LAE); Wissel Lake Region, s. of border of Lake Paniae, foot of Mt. Poti, *Eyma 4538* (†A). TERRITORY OF NEW GUINEA. Western Highlands District: Al River mountains, Nondugl, *Womersley NGF5361* (†A, LAE). Eastern Highlands District: Chimbu, *Cavanaugh NGF3329* (†LAE). Morobe District: Oberamnang, *Clemens 5434* (†A); Sattelberg, *Clemens 2276* (A); Mongi valley, below Salawaket, *Lane-Poole 524* (†BRI).

This variety differs from the species in the very thick twigs and widely spreading leaves which do not have revolute margins. The hypodermal fibers are somewhat larger. Transverse sections of the leaves of *Cavanaugh NGF3329* and *Lane-Poole 529* have three very large vascular canals and the latter specimen has two smaller ones in addition. Auxiliary sclereids were seen only in *Clemens 5434* and *Eyma 4538*.

21. *Podocarpus nakaii* Hayata, Ic. Pl. Formosa 6: 66. 1916; Pilger, Nat. Pflanzenfam. ed. 2. 13: 248. 1926; Florin, Svenska Vet.-Akad. Handl. III. 10: 279. 1931.

A tree with terete, glabrous branchlets. Terminal buds globose, outer scales short, 3 mm. long, with acute or short-acuminate spreading tips. Leaves crowded at the ends of twigs, spreading, linear-lanceolate or linear, 5–10 cm. long, 8–11 mm. broad (sometimes up to 14 mm. broad), straight or falcate, shiny above, paler beneath, the apex acute or shortly attenuate, at the base gradually narrowing to petioles 5 mm. long; midrib broadly prominent or flat above, rarely narrow, very broad below. Transverse sections of the leaves show 3 vascular resin canals (sometimes obscure), upper hypoderm of few and scattered small fibers 13–28 μ in diameter interrupted at the midrib, no hypodermal fibers between the stomatal rows, vascular sclereids absent above and rare below the bundle, auxiliary sclereids absent. Pollen cones unknown. Ovulate cones solitary in the leaf axils; peduncles 2–7 mm. long; receptacle fleshy and subtended by two thick triangular bracts 1.5 mm. long, 1 mm. wide. Seed oblique-globose, crested, 1 cm. long, 8 mm. thick.

DISTRIBUTION: Known only from Formosa on mountain slopes.

Formosa: Hassen-zan, *Kanehira 21184* (A, †UC, UCLA); Sui-sya, *Kanehira 740* (†UC); Rengeti, *Hayashi 21208* (A, NY, †UC), *Kanehira 316* (A); Nanto, Tahiken, *Wilson 9935* (A–5 sheets, †US), *Wilson* in 1918 (P); above Shushu, *Wilson 10023* (A–3 sheets); around Honsha, *Wilson 9937* (A–3 sheets); Shinchiku Prov., forests beyond Nanoaherzan, *Wilson 10319* (†A).

Podocarpus nakaii, according to the description, differs from *P. nerii-folius* by the very short (2–4 mm.) peduncle of the fruit and the short, thick triangular bracts subtending the receptacle; and I find the terminal buds have shorter acute scales. The peduncles on *Kanehira 740*, however, are 7 mm. long. Transverse sections of the leaves show thicker palisade

than is found in *P. neriifolius*. As Orr (9) suggests, the species is not readily distinguished from *P. macrophyllus* by means of leaf anatomy.

22. *Podocarpus rumphii* Blume, *Rumphia* 3: 214. 1847; Gordon, *Pinetum* 282. 1858, ed. 2. 346. 1875; Carrière, *Traité Conif.* ed. 2. 663. 1867; Parlatore, *DC. Prodr.* 16: 515. 1868; Bertrand, *Ann. Sci. Nat.* V. 20: 59. 1874; Van Tieghem, *Bull. Soc. Bot. France* 38: 169. 1891; Warburg, *Monsunia* 1: 193. 1900; Pilger, *Pflanzenreich IV.* 5 (Heft 18): 81. 1903, *Bot. Jahrb.* 54: 210. 1916, *Nat. Pflanzenfam.* ed. 2. 13: 248. 1926; Foxworthy, *Philip. Jour. Sci.* 6: 164. 1911; Dallimore & Jackson, *Handb. Conif.* 55. 1923, 1931, 80. 1948; Wasscher, *Blumea* 4: 432. 1941.

A tree 20–33 m. high with straight branches and subverticillate twigs. Terminal buds on the twigs globose or ovate, with thick, keeled outer scales which are acute or acuminate, rarely obtuse. Leaves erect or patent, coriaceous, linear-lanceolate, straight or subfalcate, more or less abruptly narrowing to the short-angustate (rarely caudate-acuminate) apex, narrowing abruptly to the short thick petiole, 6–25 cm. long, 10–29 mm. broad, margins parallel or nearly so; midrib broadly prominent above or scarcely evident, less so below. Transverse sections of the leaves show 3 vascular resin canals, interrupted upper hypoderm with fairly small fibers, no hypodermal fibers between the stomatal rows below, almost always vascular fibers but rarely auxiliary sclereids. Male cones axillary, solitary or clustered 1–3, sessile, or on short 1.5–3 mm. peduncles, strobili to 4 cm. long, 3 mm. in diameter. Microsporophylls nearly ovate-triangular, apiculate. Female strobili solitary, axillary; peduncle 2–16 mm. long; receptacle of 2–4 fused fleshy scales with narrow, obtuse free apex, subtended by 2 subulate bracts, 6–10 mm. long, 3.5–8 mm. in diameter. Seeds 1 or 2, globose-ellipsoid, grayish when ripe, 10–13 mm. long, not crested.

DISTRIBUTION: Usually a mountain tree in forests of Borneo, New Guinea and some of the smaller islands in this region.

Borneo. BRITISH NORTH BORNEO. Mt. Kinabalu: Gurulau Spur, *Clemens* 50691 (A, †BM, †UC); Penibukan Ridge, *Clemens* 50051 (A, UC), For. Dept. 2174, *Apostol s.n.* (UC). SARAWAK: Bidi Cave, near top of mountain, *Clemens* 20656 (†NY). SOUTHEAST BORNEO: Sampit, *Buwalda* 7793 (†A), peak of Balikpapan, *Kostermans* 7408 (†LAE). JAMBONGAN ISLAND: Sanakan, *Cabiling*, For. Dept. 3710 (UC).

Moluccas. Weda, Weda, *Anon. Boschpr.* bb24924 (A). MOROTAI: G. Pare 2, *Kostermans* 1210 (A, LAE). AROE ISLANDS: Dosinamalaoe, P. Kobroor, *Boschpr.* bb 25289 (A), *Buwalda* 4988 (†A); Selibatabat, P. Wokam, *Boschpr.* bb 25415 (†A), *Buwalda* 5271 (†A); Wakatoebi, P. Oedjir, *Boschpr.* bb25438 (†A). AMBOINA: *Robinson* 309 (NY).

New Guinea. TERRITORY OF NEW GUINEA. Sepik District: Aitape, *Smith* NGF1241 (BRI, †LAE–2 sheets). Eastern Highlands District: Aiyura, *Smith* NGF1102 (BRI, †LAE); Tumoma River, *Masters* 1341 (†BRI); Chimbu, *Cavanagh* NGF3336 (†A). Morobe District: Matap, *Clemens* 11133 (†A). PAPUA. Central Division: Rona, *Brass* 6208 (†A); Koitaki, *Carr* 12842 (†A). Gulf

Division: Kikori River delta, *Hart NGF4545* (†LAE-2 sheets). Milne Bay District: Misima Island, *Schacht NGF2762* (†BRI, LAE).

Solomon Islands. SAN CRISTOBAL: ridge forest, *Logie BSIP357* (†LAE).

The description for this species was taken from the specimens examined and from Pilger (1903). These specimens all show leaves with a broad, scarcely prominent midrib and abruptly acute apex which distinguish *Podocarpus rumphii* from *P. neriifolius*; I find that these characters also distinguish it from *P. ledermannii*. Wasscher (11) included in *P. rumphii* specimens of *P. philippinensis* and some specimens from Celebes which I am excluding from *P. rumphii*.

The male specimen, *Buwalda 7795*, has solitary sessile, globose male cone buds. The seeds on the female specimens are very immature. Wasscher includes *Clemens 50691 and 50051* under *P. neriifolius*, but the broad midrib and the leaf anatomy are so like *Buwalda 7795* that these should both be considered as *P. rumphii*. *Cabiling s.n.* has a narrowly prominent midrib and caudate-acuminate apex on the leaves, but their very large size, 19.3 cm. long and 24 mm. wide, suggest that it is a juvenile example of this species.

Orr (9) examined the leaf anatomy of *Podocarpus rumphii* in transverse section and described lower hypodermal fibers between the stomatal rows. I do not know what specimens he used, but I found a few fibers only in *Smith NGF1102*.

Wasscher's description excluded caudate-acuminate apices of the leaves, but I find that some specimens which have such leaves must be included in *P. rumphii*.

The specimens listed from the Moluccas have large, broad leaves with nearly parallel margins and tips abruptly acute or acuminate. The midrib is broadly or scarcely prominent above. One of the specimens with seeds, *Buwalda 4988*, has peduncles 6–16 mm., longer than the type, and the seed is up to 13 mm. long. The male cones are solitary or clustered and sessile or short peduncles in *Kostermans 1210* and *Buwalda 5271*.

Most of the specimens from New Guinea had been tentatively ascribed to *Podocarpus neriifolius*, but the very broadly prominent upper midrib and the parallel margins of the leaves proved to be satisfactory criteria for their inclusion in *P. rumphii*. The foliage on these specimens is usually much larger.

Smith 1102, from Aiyura, is a sterile specimen with very large drooping leaves clustered at the tips of the twigs and reminds one of *Podocarpus deflexus* from the Malay peninsula. Transverse sections of the leaves show 5 resin canals below the vascular bundle but the hypodermal fibers are smaller, there are no auxiliary sclereids and the lower hypodermal fibers are fairly numerous; these are not characteristics of *P. deflexus*.

23. *Podocarpus costalis* C. Presl, Epimel. Bot. 236. 1849; Pilger, Pflanzenreich IV. 5 (Heft 18): 78. 1903, Pflanzenfam. ed. 2. 13: 248. 1926; Florin, Svenska Vet.-Akad. Handl. III. 10: 279. 1931; Dallimore & Jackson, Handb. Conif. 42. 1931, 64. 1948.

Tree or shrub (?) with thick, short, densely leafy spreading branchlets. Terminal buds short, 2–2.5 mm. long, ovate with thick, stiff, keeled, closely appressed scales with obtuse apex, as long as the bud. Leaves erect to patent, crowded, coriaceous, oblanceolate, sometimes rounded, obtuse, or even emarginate at the apex, narrowing rather gradually from above the middle to a short, thick petiole, 3.8–7.0 cm. long, 7–10 mm. broad; midrib broadly prominent above, rarely embedded in shallow grooves, below broad and scarcely evident or shallowly impressed. Transverse sections of the leaves show uniformly three vascular resin canals, interrupted upper hypoderm, no hypodermal fibers between the stomatal rows and no auxiliary sclereids. Male cone buds subglobose, 2–2.5 mm., solitary, sessile, with obtuse-rotundate outer scales; mature cone thick cylindrical, 3 cm. long. Female cones solitary, axillary; peduncles 2 mm. long; receptacle of two fused fleshy equal scales with rounded tips, 7 mm. long, subtended by two very minute bracts. Seed elliptical, obtusely crested at the tip, dark when dry, 7–9 mm. long.

DISTRIBUTION: Shores of several of the Philippine Islands and Formosa.

Philippine Islands. BABUYAN ISLANDS: Dalupiri, *Bartlett 15138* (A), *15192* (†A). BATANES ISLANDS: Mahatow, For. Bur. 80397, *Ramos* (†NY). POLILLO ISLAND: For. Bur. 29682, *Salvoza* (†NY, UC). BUCAS ISLAND: For. Bur. 5268, *Merrill* (†NY). **Formosa:** Isl. Koto-syo, *Mori 315* (†A).

The description of *Podocarpus costalis* was drawn up from the specimens cited and from Pilger's description (1903). The only likely suggestion as to the locality of the original collection by Haenke is Luzon, but I have seen no other collections of this species from there. The only specimen included here which has been examined previously is For. Bur. 5268, *Merrill*; it was placed in *P. polystachyus* by both Foxworthy and Wasscher in spite of the spatulate shape of the leaves. Foxworthy's description (5) under *P. costalis* is referred to *P. pilgeri* since all of the specimens he used are cited under that species, no doubt rightly, by Wasscher (11).

Podocarpus costalis differs from *P. polystachyus* in the thick, spatulate leaves which are usually erect on the twigs. Transverse sections of the leaves show more abundant upper hypodermal fibers of smaller diameter in *P. costalis*. Orr (9) included *P. costalis* with those species having lower hypodermal fibers but I did not find these in any case. Both species are found at sea level in coastal areas.

The Formosan specimen (*Mori 315*) differs from the others in having vascular fibers.

24. *Podocarpus thevetiifolius* Zippel, *Flora* 12: 287. 1829 (nomen!); Blume, *Rumphia* 3: 213. 1847; Carrière, *Traité Conif.* ed. 2. 669. 1867; Parlato, DC. *Prodr.* 16: 518. 1868; Gordon, *Pinetum* ed. 2. 349. 1875; Warburg, *Monsunia* 1: 192. 1900; Pilger, *Pflanzenreich* IV. 5 (Heft 18): 79. 1903, *Bot. Jahrb.* 54: 210. 1916, *Nat. Pflanzenfam.* ed. 2. 13: 248. 1926; Dallimore & Jackson, *Handb. Conif.* 56.

1923, 1931, 83. 1948; Florin, Svenska Vet.-Akad. Handl. III. 10: 280. 1931; Wasscher, Blumea 4: 462. 1941.

A small tree, 10–23 m. tall, with numerous, scattered, sometimes opposite spreading branches. Vegetative buds small, ovate-acute; bud scales adpressed, acute, 1.5 mm. long. Leaves scattered below, but closely crowded near ends of twigs, thin-coriaceous, lanceolate, acute or obtuse at the apex, rarely mucronate, gradually narrowing to a short petiole; midrib broad, flat, not prominent above, scarcely prominent below; margins of blades not revolute, flat and [fide Wasscher (11)] with a distinct narrow shining line along the margins, 2.5–8 cm. long by 5–9 mm. wide. Transverse sections of the leaves show an interrupted upper hypoderm of very large fibers, no hypoderm fibers between the stomatal rows, vascular fibers usually present above the bundle, auxiliary sclereids absent in the mesophyll. Pollen cones unknown. Female cones axillary, solitary; peduncles slender, 3–8 mm. long; receptacle [fide Blume (1847)] twice as thick as the seed. Seed ellipsoid, 10 mm. long.

DISTRIBUTION: New Guinea.

New Guinea. NETHERLANDS NEW GUINEA: Lobo, *Zippel s.n.* (†ex Florin). PAPUA. Northern Division: Isuarava, *Carr 15395* (†A).

This species may be distinguished from those closely related to it by the small, thinner, flat leaves without prominent midrib above and the small terminal buds with very short scales. The margins of the leaves are not revolute as in *Podocarpus archboldii*. In both specimens the diameter of the hypodermal fibers is large, sometimes up to 70 μ .

25. *Podocarpus forrestii* Craib & W. W. Smith, Notes Bot. Gard. Edinburgh 12: 219. 1920; Dallimore & Jackson, Handb. Conif. 46. 1923, 1931, 69. 1948; Florin, Svenska Vet.-Akad. Handl. III. 10: 279. 1931.

A shrub up to 3.5 m. high with fairly stout branches. Vegetative buds small, ovate. Leaves 3.5–5.4 cm. long, 6.5–9 mm. wide, oblong or oblong-lanceolate, obtuse or rounded at the apex, gradually narrowing at the base into a short, winged petiole, dark green above, pale beneath; midrib broadly prominent above. Pollen cones unknown. Female cones usually solitary in the leaf axils, pedicels 8 mm. long, ovule on a short fleshy receptacle. Mature seeds unknown.

DISTRIBUTION: Eastern and western sides of the Tali Range in western China.

China. YUNNAN: Tali Range, *Forrest 6852* (†E).

Podocarpus forrestii is distinguished from *P. macrophyllus* var. *maki* by its dwarf habit and shorter, broader leaves. The upper midrib is not as abruptly prominent. I have examined the transverse section of leaves from only one specimen and I find that the leaf anatomy is very similar to that of *P. macrophyllus*, its var. *maki*, and *P. nakaii*. The interrupted

upper hypoderm is of small fibers; rarely are there any vascular fibers, and I found no auxiliary sclereids. As the few differences seem to be only a matter of degree, it may well be that these are all forms of *P. macrophyllus*.

26. *Podocarpus pilgeri* Foxworthy, Philip. Jour. Sci. Bot. 2: 259. 1907, 6: 149. 1911; Pilger, Nat. Pflanzenfam. ed. 2. 13: 248. 1926; Florin, Svenska Vet.-Akad. Handl. III. 10: 280. 1931; Dallimore & Jackson, Handb. Conif. 54. 1931, 79. 1948; Wasscher, Blumea 4: 463. 1941.

Podocarpus celebica Warburg, Monsunia 1: 92. 1900, non Hemsley 1896; Pilger, Pflanzenreich IV. 5 (Heft 18): 78. 1903.

Podocarpus schlechteri Pilger, Bot. Jahrb. 54: 209. 1916, Nat. Pflanzenfam. ed. 2. 13: 248. 1926; Florin, Svenska Vet.-Akad. Handl. III. 10: 280. 1931; Wasscher, Blumea 4: 463. 1941.

Podocarpus costalis auct. non Pilger, Foxworthy, Philip. Jour. Sci. Bot. 6: 161. 1911.

A small tree or shrub, 2–15 m. tall, rarely taller, with scattered or verticillate branches. Terminal buds ovate-acute with narrowly triangular scales, sometimes long acuminate, keeled, to 4.5 mm. long. Leaves scattered or crowded near the tips of twigs, spreading, usually thick coriaceous, rigid, usually flat, linear-lanceolate to oblong, cuneately or more gradually narrowed to the short petiole, abruptly or rather gradually narrowed to an acute apex, sometimes apiculate, 1.5–8 cm. long, 4–13 mm. broad; midrib narrow and sharply prominent above, keeled, flat, or even channelled below. Transverse sections of the leaves show 1–3 vascular resin canals, the central one sometimes being larger; the upper hypoderm is usually of large isolated fibers, sometimes several in a group and rare fibers on the lower side between the stomatal rows; vascular sclereids or fibers are usually present. Male cones solitary, axillary, subsessile, scales ovate-triangular and acute, cylindrical, 1.5–5 cm. long, 2–4 mm. in diameter; microsporophylls broadly triangular, apiculate with a scarious margin. Female cones solitary, axillary; peduncles 3–12 mm. long; receptacle of two fused fleshy bracts, obtuse and free at the tips, 5–12 mm. long, 3–7 mm. thick, subtended by a pair of subulate bracts 1.5–2 mm. long. Seed elliptic-globose, obtuse, 8–8.5 mm. long, 7 mm. broad.

DISTRIBUTION: Mountains between 1400–3000 m. altitude on islands from the Philippines to the Solomons, and one collection from Siam.

Philippine Islands. LUZON: Tayabas, Mt. Banajao, Foxworthy, Bur. Sci. 2393 (†NY), Gates 7254 (†F), Copeland s.n. (†UC); Lucban, Elmer 7778 (A, †MO, NY); Rizal, Loher in 1914 (†UC). MINDORO: Mt. Halcon, Merrill 5754 (†NY, isotype). NEGROS: Canlaon Volcano, Merrill 241 (†A). MINDANAO: Misamis Prov., Mt. Malindang, Mearns & Hutchinson, Bur. Sci. 4673 (†BR, †NY); Agusan Prov., Cababaran, Mt. Urdaneta, Elmer 14086 (A, F, GH, †MO, NY, †UC); Bukidnon Subprov., Mt. Lipa, Ramos & Edanō, Bur. Sci. 38500 (A).

Celebes. Gowa, Lembaja, Boroë, Boschpr. bb20437 (A).

New Guinea. NETHERLANDS NEW GUINEA: Idenburg River, Bernhard Camp,

Brass & Versteegh 13519A (†A-2 sheets); NE Lake Habbema, Bele River, *Brass 11341* (†A, LAE); Subdistr. Manokwari, summit of Arfak Mountains, Vogelkop, Angi gita Lake, *Kostermans 2161* (†A), *2236* (†A), *2519* (†A). TERRITORY OF NEW GUINEA. Western Highlands District: Wahgi-Sepik Divide, *Womersley & Millar NGF6980* (A, LAE); Wahgi-Jimmi Divide, *Womersley NGF5316* (A, †LAE); Mt. Hagen, *Cavanaugh NGF3324* (†LAE). Bismark Mountains, *Schlechter 18780* (†BR, †UC). Morobe District: Wau-Mubo Road near Skindewai, *Womersley & Millar NGF8341* (A, LAE); NE Oberam nang, *Clemens 4569* (A), *4696* (†A); Edie Creek, *Womersley NGF5373* (A, †LAE); above Wau, *McAdam NGF440* (BRI, †LAE). PAPUA. Central Division: Mt. Tafa, *Brass 4034* (†NY); above the Gap, *Carr 13721* (†A); Boridi, *Carr 14563* (A), *14556* (†A); Mt. Obree, *Lane-Poole 357A* (†BRI). Milne Bay District: Maneau Range, north slopes of Mt. Dayman, *Brass 22811* (A).

Solomon Islands. SANTA ISABEL ISLAND: *Brass 3265* (†A). SAN CRISTOBAL ISLAND: on ridge, *Logie NGF354* (LAE).

Siam. Kao Knap, Krat, *Kerr 17809* (†BM).

This description has been limited to those specimens obtained from the higher altitudes. Therefore it includes all of the specimens from the Philippine Islands listed by Foxworthy (5) as *P. costalis* and which were later referred to *P. pilgeri* Foxw. by Wasscher (11). The name *P. schlechteri* Pilger is still being retained by some workers for specimens with small, linear-lanceolate leaves which are pointed at both ends. There is so much variation, however, in the foliage of *P. pilgeri*, even within the same specimen, that these must be included here.

Kerr 17809, from Siam, has exceedingly immature fruit, but the foliage is so like that of many specimens of *Podocarpus pilgeri* that I refer it to that species. It is said to be a small tree, 1.8 m. high, not uncommon in high evergreen forest. Transverse sections of the leaves show more abundant upper hypoderm fibers than most other specimens. This specimen and those from New Guinea often show a few auxiliary sclereids in the mesophyll, but these are lacking in the Philippine specimens.

27. *Podocarpus neriifolius* D. Don ex Lamb. Pinus ed. 1. 1: 21. 1824, ed. 2. 2: 122. 1828 (in part); Endlicher, Syn. Conif. 215. 1847; Gordon, Pinetum ed. 1. 279. 1858, ed. 2. 343. 1875; Carrière, Traité Conif. ed. 2. 661. 1867; Parlatore, DC. Prodr. 16: 514. 1868; Bertrand, Ann. Sci. Nat. V. 20: 59. 1874; Van Tieghem, Bull. Soc. Bot. France 38: 169. 1891; Kent in Veitch, Man. Conif. 152. 1900; Pilger, Pflanzenreich IV. 5 (Heft 18): 80. 1903, Bot. Jahrb. 54: 210. 1916. Nat. Pflanzenfam. ed. 2. 13: 248. 1926; Bernard, Beih. Bot. Centralbl. 17: 293. 1904; Foxworthy, Philip. Jour. Sci. 2: 258. 1907, 6: 162. 1911; Dallimore & Jackson, Handb. Conif. 52. 1923, 1931, 77. 1948; Wilson, Jour. Arn. Arb. 7: 41. 1926; Florin, Svenska Vet.-Akad. Handl. III. 10: 279. 1931; Merrill, Contr. Arnold Arb. 8: 15. 1934; Wasscher, Blumea 4: 437. 1941.

Myrica esquirolii Leveillé in Fedde, Rep. Sp. Nov. 12: 537. 1913; Rehder, Jour. Arnold Arb. 10: 108. 1936.

Podocarpus bracteata Blume, Enum. Pl. Javae 88. 1827-8; Van Tieghem, Bull. Soc. Bot. France 38: 169. 1891.

Podocarpus discolor Blume, Rumphia 3: 213. 1847.

Podocarpus junghuhniana Miquel, Pl. Junghuhn 1: 2. 1851; Van Tieghem, Bull. Soc. Bot. France 38: 169. 1891.

Podocarpus leptostachya Blume, Rumphia 3: 214. 1847; Van Tieghem, Bull. Soc. Bot. France 38: 169. 1891.

Podocarpus macrophylla var. *acuminatissima* Pritzl, Bot. Jahrb. 29: 213. 1900.

Podocarpus neriifolius var. *brevipes* Pilger, Pflanzenreich IV. 5(Heft 18): 81. 1903.

Podocarpus neglecta Blume, Rumphia 3: 213. 1847.

A medium sized tree up to 40 m. tall (rarely larger) with very spreading branches and numerous branchlets. Terminal buds ovate with ovate-triangular to long-subulate outer scales usually as long as or longer than the bud, 5-7 mm. long. Leaves scattered, usually large, 7-15 cm. long, 9-13 mm. wide (sometimes longer and up to 19 mm. wide), straight or falcate, spreading, usually very gradually narrowing to an acute apex, and less gradually to a short petiole; midrib narrowly prominent above, broad and prominent below. Transverse sections of the leaves show 3 vascular resin canals below the bundle, vascular sclereids or fibers usually present above the bundle and more rarely below; no auxiliary sclereids, the interrupted upper hypoderm in small groups of from 1-7 fibers, 20-40 μ in diameter, no hypodermal fibers between stomatal rows, palisade mesophyll of a single layer. Pollen cones solitary, sessile, axillary, ovate, large, with usually thick, coriaceous, acute outer scales, the inner scales thinner and scarious, mature cones 2-8.5 cm. long, 2.5-4.5 mm. in diameter. Microsporophylls narrow, short, acute or obtuse, often apiculate. Female cones solitary in leaf axils, usually remote, peduncles 3-24 mm. long; the fleshy receptacle subtended by two subulate bracts 2-6 mm. long. Seeds 9-16 mm. long, narrow ovoid, sometimes globose but gradually narrowed toward the tip.

DISTRIBUTION: Subtropical evergreen forest, 650-1300 m. altitude in the Himalayas, eastward into China, and south into the Malay Peninsula; on insular lands from Japan south into Java, west to Sumatra and the Andaman Islands, eastward as far as the Fiji Islands.

India. NEPAL: *Wallich 6052A* (Type, †BM, †BR, †NY, †P), *Wallich* in 1818 (MEL, MO), *Anon.* 1819 (BR), *Scheidweiler s.n.* (†BR), *Lambert 45* (†BR), *Martius* in 1819 (†BR). ASSAM: Khasia, Jowae, *Clarke 18362* (†A); Jaiutea Hills, *Mann s.n.* (A); tropical region, *Hooker & Thomson* in 1856 (†MEL, PH); Sibebium (?), *Thomson s.n.* (GH); *Masters s.n.* (†P, †PH); *Simons s.n.* (†P). EAST BENGAL: *Griffith 5006* (GH), *Clarke 19721* (MEL). **North Burma:** Ngawchang Valley, N of Htawgaw, *Ward 173* (†A, NY); between Htawgaw and Lanyang, *Ward 311* (NY).

China. Western China, *Wilson 3007* (A). SZECHWAN: Mt. Omei, *Fang 2346* (A, †NY, P), *Faber 985* (NY). KWEICHOW: Tsunyi, *Cheng 5317* (†NY); Lo, *Cavalerie 3463* (†A), *3465* (†P), *Esquirol 3223* (†A, †P). CHEKIANG: south of Ping Yung, *R. C. Ching 1982* (†A, GH, †UC). YUNNAN: Seyemeo Ulo, *Henry*

12919 (A, †MO, NY-2 sheets). KWANGSI: Me-kon, Seh-feng Dar Shan, S. Nanning, *R. C. Ching* 8417 (A-2 sheets, GH, †UC); Shang-sze Dist., Shap Man Taai Shan, *Tsang* 24761 (MO, NY).

Siam: Bangkok, *Kerr s.n.* (†BM); Kao Sem, Kouate, *Kerr* 9907 (†BM); Klawry Ton, *Kerr* 14586 (†BM); Kao Knap, Krat, *Kerr* 17833 (†BM); *Garrett* 538 (†BM). **Indochina.** ANNAM: Tourane, *Clemens* in 1927 (†UC); *Bordeneuri* 36731 (†P); *Forest Service* 48 (†P). CAMBODIA: *Poilane* 15209 (†P). COCHIN CHINA: Chiang in Prov. Bienhoa, *Pierre* 5532 (†A, NY, †P); near Baria?, *Pierre* 5532 (A).

Malaya. PERAK: *Wray* 2922 (A). PAHANG: Fraser Hill, *Anon.* 11024 (†A). PENANG: Government Hill, *Haniff* 334 (†BISH, NY), *Curtis* 3079 (A); Balik Pulau, *Hu* 9422 (A); Tulo, *Glandoger* in 1906 (†MO).

Japan. KYUSHU: Urumai Prov., Higashikirishima, *Wilson* 6210 (A-2 sheets); no locality, *Sargent* in 1892 (A). **LiuKiu Islands:** Mt. Genka, Kunchon, *Wilson* 8153 (A). **Formosa:** Shinchiku Prov. beyond Nauvaheizan, *Wilson* 10319 (A); Lake Candidius, *Kanehira* 21309 (A, UC). **Philippine Islands.** LUZON: Benguet, Mt. St. Tomas., For. Bur. 31479, *Esquerria* (†NY); Bontoc, Mt. Data, *Clemens* 16251a (†CAS, UC), For. Bur. 10894, *Curran* (NY), For. Bur. 14422, *Darling* (NY); Tayabas, Mt. Binuang, For. Bur. 28635, *Ramos & Edanō* (A). POLILLO: *McGregor* 10779 (†NY).

South Andaman: Anderson 26, *Kerr s.n.* (†P); *Dr. King* 208 (A). **Sumatra:** NW Lake Toba near Piso Piso, *Bangham* 1116 (†A, NY); road from east coast to Tapanoeli, *Bangham* 1128 (A, †NY); Tapanoeli, Sipirok, Panobasan, Dk. Poehoeten Lajan, *van Steenis Boschpr. bb* 30986 (MO). **Mentawai Islands:** Pulau Siberoet, Sebai-bai, *Anon. Boschpr. bb* 17444 (A). **Borneo:** southern part, *Korthals s.n.* (†MEL).

Java. PROV. PREANGER: above Tjibodas, *Christopherson* 156 (†BISH), *Koorders* 1243β (A); Pangentjongan, forest Pasir Kajoejoetan, *Koorders* 26553β (†A-3 sheets), *Koorders* 1260β (A); Tjitjalengka, *Koorders* 14206β (†A); Parakansalak, G. Poetri, Tjikramat, *Koorders* 39405β (A); Tjilaki, southeast Java, *Forbes* 924 (A, †MEL); Semarang Oenganan, *Koorders* 1223β (BRI); Mt. Kaukuban, Prau, *Anderson* 69 (†MEL); Tjikramat, *Warburg* 2678 (†NY); G. Tiloe, Pengalengan, *Warburg* 11118 (NY); Boerangrang, Goenseng Soenda, *Bakhuizen Van den Brink* 4586 (UC). Without locality: *Martius s.n.* (†BR), *Blume s.n.* (NY), *Junghuhn* 2 (†GH) *Zollinger* 2019 (BM, †MEL), *Anon.* (†MEL-3 sheets).

New Guinea. NETHERLANDS NEW GUINEA: Japen, Seroei, *Boschpr. bb* 30698 (†A), *bb* 30699 (A), *bb* 30727 (†MO), *bb* 30803 (A), *bb* 30903 (A); Dalman, Nabire, *Kanehira & Hatusima* 12266 (A). TERRITORY OF NEW GUINEA. Sepik District: Yellow River hills near Sepik River, *Womersley NGF* 3937 (LAE-2 sheets), *Womersley NGF* 3919 (†LAE-2 sheets). Eastern Highlands District: Aiyura Range, *Womersley NGF* 3374 (LAE). Madang District: Kani Gebirge, *Schlechter* 16740 (UC). Morobe District: Boana vicinity, *Clemens* 8158 (†A); Morobe, *Womersley NGF* 3128 (†BRI, LAE). PAPUA. Western Division: Palmer River below junction of Black River, *Brass* 7299 (A, †LAE); Oriomo River, Wurio, *Brass* 5907 (†A, BRI, CAS, MO, NY), 5908 (†A, BRI, NY); above sawmill, *Hart NGF* 5019 (†LAE). Gulf District: Murua River, *Brass* 1344 (A). Northern Division: foothills of Hydrographer Range near new Inoto village, *Hoogland* 3845 (†LAE); foothills of Hydrographer & Owen Stanley Range, *Lane-Poole* 238 (A, †BRI), 275 (A, †BRI); Ioma, Manbare River, *Allen & Martin NGF* 3283 (A, †BRI, LAE); Dobodura Plain, near Embi Lakes, *Cavanaugh & Fryar NGF* 2087

(BRI-2 sheets, LAE-2 sheets). Central District: Kokoda Track Plantation near Sogeri, *Womersley NGF4158* (†A, LAE); Sogeri, *Smith NGF132* (†BRI); Uberi, Eilogo Mill, *1 Aust. Ore. NGF E.24* (BRI), *Anon. NGF48* (LAE); Hombron Bluff, near Pt. Moresby, *Gray & McDonald NGF7137* (†LAE). Milne Bay District: Milne Bay area, Dawa Dawa River, *Smith NGF1322* (†LAE). Goodenough Island: east slopes, *Brass 25023* (A). NEW BRITAIN: Mavalu River, *Anon. NGF2897* (†A, †LAE). **Solomon Islands.** MALAITA: Dingali, interior from Quoi-monapu, *Kajewski 2370* (A, †BISH, BM, BRI). NEW GEORGIA: *Waterhouse 209* (†K).

Fiji Islands. VITI LEVU: Mba, Singatoka River, *Gillespie 3866* (DS, NY, †UC, US); hills between Nandala and Nukumuku creeks, *Smith 6167* (A, †ILL); Naitasiri, vicinity of Nandarivatu, *Gillespie 4033* (†BISH), *4281* (†BISH); Sovutawambu, *Degener 14670* (†A, MO, NY, US); woods near road part Tamavua Village, *Gillespie 2143* (†BISH); Prince's Road forest, *Parham 805* (†A); Namosi, Voma Mountain, *Gillespie 2910* (†BISH), Naitarandamu Mt., *Gillespie 3363* (†BISH). VANUA LEVU: Mathuata, Seangangga Plateau in drainage of Korovuli River, vicinity of Natua, *Smith 6721* (A, †ILL); south slopes of Mt. Numbiuloa, east of Lambasa, *Smith 6385* (A, †ILL), *Smith 6570* (A, †ILL). VANUA MBALANU: *Bryan 575* (BISH, †ILL). TAVIUNI: Somo Somo, *Gillespie 4840* (†BISH, NY, UC). OVALAU: near summit of range west of Levuka, *Gillespie 4433* (†BISH, †UC). NGAU: hills inland from Sawaieke, *Smith 7783* (†US). Exact locality not indicated: *Anon. U. S. South Pacific Expl. Exped. 1838-43* (†US).

Without locality: *Horsfield Herb. s.n.* (GH), *Anon.* (GH), *Kurz* (ex Herb. Sulp. Kurz) (A).

Cultivated. JAPAN: *Oldham* in 1861 (GH), Hort. Grieb., *Anon.* in 1849 (MO). CEYLON: Peradeniya Gardens, *Galston 2486* (†UC). JAVA: Hort. Bogor. *V.F.33* (GH, NY), Bot. Hard. Buitenzorg, *Sargent* in 1903 (A). ENGLAND: Kew Royal Botanic Gardens, *Cook* in 1937 (†ILL).

The preceding description of *Podocarpus neriifolius* D. Don is limited to specimens from Nepal (the type locality), Bengal, Assam and northern Burma. This species has such a wide geographical range and varies so much from the type that it can be best understood by consideration of the specimens from separate regions. *Podocarpus neriifolius* occurs on the continent of Asia in China, to the east, and in Siam, Indochina and the Malay Peninsula, to the south, and on islands from Japan in the north, southward to Sumatra and Java, and eastward through Malaysia to the Fiji Islands.

Transverse sections of leaves of specimens from Nepal show leaves thin, often to the point that some, or all three of the vascular resin canals are obscured beyond recognition. There are no true auxiliary sclereids in the mesophyll but the cell walls are frequently thickened, without pits, and in many leaves the cells are large with little cytoplasm. Sometimes the upper hypoderm, between the margin and the midrib, exists as only a few isolated fibers of medium or even small diameter.

In China, the foliage is usually large and like that of the trees in Nepal. However, *Fang 2346* and *Esquirol 3223* have smaller leaves, not over 8 cm. long and 7.5 mm. wide, but the long-angustate apex is like that of the type, thus placing them in this species. Transverse sections of the leaves show essentially similar anatomy. The upper hypoderm is more

abundant and in larger groups of fibers (up to 24) and vascular fibers are rarer above the vascular bundle. *Fang 2346* shows a few hypodermal fibers between the stomatal rows and this specimen and *Cheng 5319* have rare auxiliary sclereids in the upper and lower mesophyll. The male cones are sessile and are usually in fascicles of two or three.

The terminal buds of the Siamese specimens are larger than the twig, globose, with broad triangular scales, the outer of which are shorter than the bud. The leaves are large, those of *Kerr 17833*, *Kerr 9907* and *Garrett 538* being over 14 cm. long with a gradually narrowing acute apex. *Kerr 17833* has the narrowest, not over 10 mm. wide. *Kerr 14586* has wide leaves which narrow abruptly to a caudate acuminate apex. In all of them, the upper midrib is quite broadly prominent and the leaves are thicker as shown in the transverse sections by the often doubled palisade parenchyma. The upper hypodermal fibers are in small groups, sometimes up to 55 μ in diameter, and are not interrupted at the midrib. In *Kerr 14586* the hypodermal fibers interrupt the palisade which is then replaced by large cells with little cytoplasm. Auxiliary sclereids are found in the lower mesophyll.

Podocarpus neriiifolius also occurs in Indochina and Cambodia. The *Clemens* specimen is said to represent "scattered trees along the river," and has leaves only 10 mm. wide. The leaves of all specimens are scattered and have the long-tapering acute apex typical of the species. Transverse sections of the leaves do not always show vascular fibers and only the *Clemens* specimen and one of *Pierre 5532* have auxiliary sclereids below the accessory transfusion tissue. *Pierre 5532* needs special comment, for two taxa are included under this number and the labels record two different collection sites, both questioned on the specimens. There are a number of sheets bearing this number in the herbaria of the Arnold Arboretum, the New York Botanical Garden and the Paris Museum, and, of these, only the specimens with large, scattered leaves having a long-tapering apex are *P. neriiifolius*. The others are *P. annamiensis*, a new taxon in which the leaves are straighter, stiffer, somewhat more crowded, much smaller with more abruptly acute apices and the transverse leaf sections show two very large lateral vascular resin canals instead of three of almost uniform size.

Of the specimens from Malaya, *Anon. 11024* has very wide leaves with the apex abruptly narrowing to a caudate-acuminate tip and long acuminate-attenuate terminal bud scales. The upper hypodermal fibers are solitary or in very small groups and are rarely interrupted at the midrib. In *Anon. 11024* the palisade mesophyll is undeveloped but cells with dense cytoplasm lie between the upper hypodermal fibers. Leaves of the *Glandoger* specimen usually show two additional lateral vascular resin canals which are associated with the transfusion tissue and the upper hypodermal fibers are scant.

Kanehira 21309 from Formosa is not *Podocarpus nakaii*. It most closely resembles the specimens of *P. neriiifolius* from the Fiji Islands.

On Luzon, in the Philippines, the leaves have very abundant upper hypo-

dermal fibers with few or short interruptions in *Clemens 16251a* and *For. Bur. 31479*, but on Polillo, *McGregor 10779*, they are rare and in small groups of 1–4 fibers. There are rare lower hypodermal fibers between the stomatal rows in *For. Bur. 31479*. In leaves of *Clemens 16251a* the palisade is often a double layer, rare in this species.

West of the Malay Peninsula, *Podocarpus neriifolius* has been collected from South Andaman Island. The leaves are thin and wide with a caudate-acuminate apex. Transverse sections of the leaves of *Kerr s.n.* show upper hypodermal fibers in small groups, also interrupted at the midrib, and a palisade of short dense cells between the fibers.

Transverse sections of leaves of plants of this species from Sumatra usually have solitary scattered upper hypodermal fibers and the hypodermal layer is interrupted at the midrib. Leaves of *Bangham 1128* show a few auxiliary sclereids below the accessory transfusion tissue. The leaves of this specimen also have abruptly caudate-acuminate apices.

Most of the Javan specimens are like those from Nepal. Some have an abruptly acuminate or caudate apex to the leaf, especially if the foliage is quite large. The *Martius* specimen has leaves with the two lateral vascular resin canals larger than the central one. Two specimens, *Reinwardt s.n.* and *Anderson 69*, have five vascular resin canals, the two extra lateral ones being very near or in the transfusion tissue. Transverse sections of the leaves show the interrupted hypoderm with fibers averaging a little larger than those of the type, often scattered or even isolated; there are lower hypodermal fibers between the stomatal rows only in the *Reinwardt* specimen; auxiliary sclereids only in *Koorders 26553β*.

Only one of the specimens which I have seen from Borneo, *Korthals s.n.*, has the narrowly prominent midrib on the upper side of the leaf which is characteristic of *Podocarpus neriifolius*. This specimen has also terminal bud scales with long-acuminate or even foliaceous tips, to 1 cm. long. Blume cited this as one of the specimens in his *P. leptostachyus*, which has been placed in the synonymy of *P. neriifolius* by Pilger (1903). The Melbourne herbarium specimen, which I examined, has a solitary, expanded but very narrow male cone.

This species is a fairly common tree in New Guinea and seems to reach higher altitudes there than in other areas. Characteristics which were found most useful in delineating the species were the slender branches, the leaves with margins not parallel and with long-tapering acute or acuminate apices, a sharply prominent upper midrib, transverse sections showing three vascular resin canals, interrupted upper hypodermal fibers between the stomatal rows, and the lack of auxiliary sclereids in the mesophyll. The terminal bud varied from ovate to globose and the length of the bud scales did not seem to be critical. Male cone buds are small and usually in sessile clusters of one to three.

Other species of this group in New Guinea are *P. thevetiifolius*, *P. rumphii*, *P. ledermannii*, *P. archboldii* and *P. idenburgensis*. Reference to the key will indicate the essential differences.

The leaves of the specimens of *Podocarpus neriifolius* from the Solo-

mon Islands are thin, broad and have a very acute or caudate-acuminate apex and the seeds are large, up to 14 mm. long. Transverse sections of the leaves show upper hypoderm and palisade as in the Borneo specimen.

Some of the specimens from the Fiji Islands cannot be clearly differentiated from the type of *Podocarpus neriifolius* in Nepal and thus are included in this species. With this inclusion the geographical range for *P. neriifolius* is greater than that of any other species. *Podocarpus oleifolius* in South and Central America extends for an almost equal distance north and south of the equator but there is little range of longitude. Here, in the Fiji Islands, *P. neriifolius* is a tree found in either open or dense forests at altitudes usually of less than 500 m. The leaves are quite thick and coriaceous, sometimes only 4 cm. long and 4 mm. wide on reproductive branches, and the margins tend to be revolute. The broad lower midrib may have an open groove, and transverse sections always show auxiliary sclereids. The pollen cones are usually clustered and sessile. Many of these specimens have been marked as *P. elatus*, a species which differs distinctly in having abruptly acute or obtuse, often mucronate tips to the leaves and continuous upper hypoderm is seen in transverse sections. One specimen, *Gillespie 2143*, has the immature seed elongate with a conspicuous crest and an elongated beak at the micropyle.

27a. *Podocarpus neriifolius* var. *atjehensis* Wasscher in *Blumea* 3: 450. 1941.

A small tree, 15 m. tall, with stout branches. Terminal buds large, the outer scales long-acuminate, to 10 mm. long, tips spreading. Leaves crowded, deflexed or drooping, linear-lanceolate, 7–18 cm. long, 5–8.5 mm. wide, very gradually narrowed to an acute, sometimes mucronate, apex, gradually narrowing to a short petiole at the base; midrib narrowly prominent above, sometimes limited by shallow grooves on either side, broadly prominent below. Transverse sections of the leaves show three vascular resin canals with the lateral sometimes larger and the median obscured, interrupted upper hypoderm of isolated fibers 23–37 μ in diameter, the layers interrupted at the midrib both above and below, rare vascular fibers only above the bundle, cuticle thick. Male cones solitary, axillary, sessile; scales acute-acuminate, up to 5 mm. long; mature cones 2–3 cm. long, 4–4.5 mm. thick. Female cones solitary in the leaf axils, crowded in the lower part of new growth; peduncles slender, 8–16 mm. long; receptacle narrowly fleshy, 7–9 mm. long, subtended by long bracts, up to 6 mm. Seed sub-elliptical, 9–10 mm. long, 7–8 mm. broad, apex obtuse.

DISTRIBUTION: In Atjeh in Sumatra, at elevations of 2250–3300 m.

Sumatra: Atjeh, Gajolanden, G. Kemiri, *Van Steenis 9614* (\dagger A).

The above description was prepared from the type specimen, the only example seen.

27b. *Podocarpus neriifolius* var. *degeneri*, var. nov.

Frutex vel arbor parva; ramulis sparsis, subverticillatis; gemmis terminalibus magnis, ovoideis, squamis exterioribus attenuatis, e basi lato crescentibus. A specie differt foliis parvis maturis, plerumque minusquam 10 mm. latis.

Shrub or small tree; branches few, subverticillate; terminal vegetative buds large, ovoid, the bud scales with apices acuminate to long-attenuate or abruptly narrowed to a long apiculus. Leaves patent to spreading, thin-coriaceous, 6–12 cm. long, 6–10 mm. wide, linear-angustate, shiny above, dull-rusty beneath, the apices narrowly acute, the bases narrowed into short petioles; leaves on young shoots to 18 cm. long, 17 mm. wide. Transverse leaf sections show 3 vascular resin canals, hypodermal fibers of somewhat smaller diameter than those of the species, vascular fibers rarely present and auxiliary sclereids lacking in the mesophyll. Pollen cones axillary on growth of the previous year, sessile, cylindrical, up to 3 cm. long, 3–3.5 mm. in diameter, surrounded at the base by numerous thin, carinate, broadly ovate scales which are sometimes apiculate; microsporophylls with small, narrow, up-turned apiculi. Female cones axillary, solitary, on slender peduncles 7–12 mm. long, the receptacle of several fused scales, 8 mm. long, with small, spreading free tips, subtended by a pair of slender, thin, attenuate bracts up to 5 mm. long, and bearing 1–2 ovules. Seeds 9–12 mm. long, elongate, 5 mm. wide, bluntly crested; immature seeds narrowed at the base.

DISTRIBUTION: along streams in forests, 40–800 m. altitude, on Viti Levu in the Fiji Islands.

Fiji Islands. VITI LEVU: Mba, Nandarivatu, *Degener 14272* (TYPE, †A, MO, NY, US); Unidawa Road near Nandala River, *Gillespie 4137* (†BISH, †DS, NY, UC); hills between Nggaliwana and Nandala creeks, south of Nauwange, *A. C. Smith 5665* (A, †ILL), *5666* (A, †ILL); 3 miles south in valley of Nandala Creek, *A. C. Smith 6254* (A, †ILL); *Gillespie 4129* (†BISH); Singatoka River, *Gillespie 4282* (†BISH, US); forest at headwaters of stream which runs to Navua, *Gillespie 4250* (†BISH, NY, UC); Lautoka Mts., *Greenwood 50A* (†A, BRI, NY), *45A* (A, BRI); Namosi, above Waikava, *Parham 1701* (†A); Nandina River, *Gillespie 2531* (†BISH, UC); Waikava, *Parham 2154* (†A); Serua, banks of Navua River, *Gillespie 3382* (†BISH, UC). Locality not indicated: *Seeman 575* (†GH). *Horne 792* (†GH). Cultivated. VITI LEVU: Exp. Sta. 17 m. east of Suva, *Buchholz s.n.* (†ILL).

27c. *Podocarpus neriifolius* var. *polyanthus* Wasscher, *Blumea* 4: 455. 1941.

Tree to 40 m. tall, slightly fluted toward base. Terminal buds large, conical; outer scales acuminate or only acute, erect, stout, often shorter than the bud. Leaves spreading, more or less coriaceous, straight or somewhat falcate, lanceolate, gradually narrowing to a short petiole, abruptly or more gradually narrowing to the acute apex, 6–16 cm. long, 13–20 mm. broad (only 6–9 cm. long, 7–8.5 mm. broad in New Guinea); midrib

narrowly prominent, broader and sometimes furrowed below. Male cones unknown. Female cones numerous, all over the new growth, in the axils of bracts as well as in those of the leaves and above the leaf scars; the few bracts sessile with a broad base, acute, to 1.5 cm. long, 2.5 mm. broad; peduncles thick, 1.5–5 mm. long; receptacle subtended by 2 subulate bracts to 3 mm. long, composed of 2–4 fused fleshy scales, only 1–2 fertile, short and thick cylindrical, 6–7 mm. long, 4–5 mm. broad. Seeds elliptical-ovate, 10 mm. long, 6 mm. in diameter.

DISTRIBUTION: In Sumatra (fide Wasscher) and New Guinea in rain forests, alt. 100–600 m.

New Guinea. PAPUA: Milne Bay District, *Smith NGF1322* (†BRI).

The specimen cited above has abundant very young ovules on the new growth at the twig tips. Dormant buds are connate to globose with short triangular obtuse scales. The leaves are small for *Podocarpus neriifolius* but they have the general shape of the species. Transverse leaf sections show the anatomy typical of *P. neriifolius* with interrupted upper hypoderm of small fibers and no hypodermal fibers between the stomatal rows of the lower side. One of the sectioned leaves shows a loosely organized palisade layer on the lower side of the leaf. This has not been found in any other specimen in Section *Podocarpus*.

27d. *Podocarpus neriifolius* var. *teysmannii* Wasscher, *Blumea* 4: 453. 1941.

Podocarpus Teysmannii Miquel, *Fl. Nederl. Indië* 2: 1072. 1859; Parlatores, DC. *Prodr.* 16: 516. 1868; Gordon, *Pinetum* ed. 2. 348. 1875; Pilger, *Pflanzenreich* IV. 5(Heft 18): 81. 1903; Dallimore & Jackson, *Handb. Conif.* 56. 1923, 1931; Florin, *Svenska Vet.-Akad. Handl.* III. 10: 280. 1931.

A small tree with stout twigs. Terminal buds globose, flattened, with short, outer scales 2–3 mm. long, these closely appressed, rigid, broadly triangular, with obtuse-acute apex. Leaves scattered, spreading, broadly lanceolate, 8.5–17 cm. long, 16–26 mm. wide, abruptly narrowing to a short, thick petiole at the base, also abruptly narrowing to the caudate-acuminate apex; midrib very broadly prominent above, ridged, flat, prominent or even channelled below. Male cone buds solitary in the leaf axils, globose, large, 3 mm. in diameter; mature cones unknown. Female cones and seeds unknown.

DISTRIBUTION: At sea level or low altitudes on Sumatra and nearby islands.

Sumatra: *Teysmann 513* (†ex Florin, Berlin Herbarium); sea coast, *Teysmann s.n.* (MEL), *Teysmann s.n.* (†MEL); Tapanoeli, Angkola en Sipirok, Panobasan, Dk. Poehoetan Lajan, *Boschpr. bb30986* (MO). **Bangka:** kajoe sembliang, *Teysmann s.n.* (†MEL). **Karimata:** *Teysmann s.n.* (†MEL–2 sheets).

According to Wasscher (11), who combined this taxon with *Podocarpus*

neriifolius, var. *teysmannii* differs from the species chiefly in the globose terminal buds, the broadly lanceolate leaves with shortly acuminate apex, and the large male cone buds.

Transverse sections of the leaves show anatomy in agreement with the species except for very rare auxiliary sclereids in the mesophyll between the accessory transfusion tissue and palisade layer. Orr's description (9) of the leaf anatomy of *Podocarpus teysmannii* must be referred to *P. philippinensis*, since the specimen he used (*Orolfo 3919* from the Selangen Islands) is here identified as the latter species.

Large, broad leaves with a caudate-acuminate apex are also found in Siam, the Malay Peninsula, the Andaman Islands, the Solomon Islands, etc. Such specimens may belong in this variety, but at present are placed in *Podocarpus neriifolius* because the terminal bud is either ovate or cannot be observed.

Wasscher (11) listed four varieties of *Podocarpus neriifolius* which must be recognized, although I have seen no specimens of any of these. They could not be included in the key to the species and varieties in this paper, therefore, but for completeness I quote the critical characters given by Wasscher and indicate the geographical location of each variety. *Podocarpus neriifolius* var. *bracteata* Wasscher, from Java, "differs . . . in the large, ovate-acute, male flower buds, with squarrose, ovate-triangular, acute bud scales." *Podocarpus neriifolius* var. *linearis* Wasscher, cited from four collections from Java, "differs . . . in the narrower leaves with margins parallel, the obtuse terminal buds and the large, ovate, male flower buds." *Podocarpus neriifolius* var. *membranacea* Wasscher, described from two collections from Celebes, "differs . . . in the membranaceous scales of the terminal buds and the ovate-acute male flower buds." *Podocarpus neriifolius* var. *timorensis* Wasscher, described from a single collection from Timor, "differs . . . in the indistinct, not or hardly prominent midrib, and the leaves shorter-narrowed toward the apex and often with a mucro, whereas the male flowers are thicker."

28. *Podocarpus polystachyus* R. Brown ex Mirb. Mém. Mus. 13: 75. 1825 (nomen!), ex Bennet in Horsf. Pl. Jav. Rar. 40. 1838 (nomen!); Endlicher, Syn. Conif. 215. 1847; Gordon, Pinetum ed. 2: 345. 1865; Carrière, Traité Conif. ed. 2, 662. 1867; Parlatores, DC. Prodr. 16: 515. 1868; Bertrand, Ann. Sci. Nat. V. 20: 59. 1874; Warburg, Monsunia 1: 192. 1900; Pilger, Pflanzenreich IV. 5 (Heft 18): 79. 1903, Nat. Pflanzenfam. ed. 2. 13: 247. 1926; Merrill, Philip. Jour. Sci. 3: 394. 1908; Foxworthy, Philip. Jour. Sci. 6: 161. 1911; Stiles, Ann. Bot. 26: 455. 1912; Dallimore & Jackson, Handb. Conif. 54. 1923, 1931, 79. 1948; Florin, Svenska Vet.-Akad. Handl. III. 10: 280. 1931; Wasscher, Blumea 4: 456. 1941.

Podocarpus littoralis Teysmann, Nat. Tijdschr. Ned. Ind. 36: 237. 1876.

P. littoralis Hort. ex Biswas, Jour. & Proc. Asiatic Soc. Bengal [Calcutta] II. 28: 374. 1933.

P. neriifolius D. Don in Lamb. Pinus ed. 2. 2: 122. 1828.

A small tree up to 20 m. tall with a trunk up to 45 cm. in diameter and numerous subverticillate spreading twigs. Terminal buds ovate with keeled, narrow, acuminate, stiff scales sometimes becoming 10 mm. long. Leaves scattered, usually crowded toward the tips of the branches, coriaceous, shiny above, usually lanceolate to linear-lanceolate, flat, 4–8 cm. long, 6–10 mm. wide (rarely somewhat wider), abruptly narrowed to the mostly obtuse apex, sometimes mucronate, gradually narrowing at the base to a short petiole; midrib prominent above, broader and sometimes shallowly channelled below. Cross sections of the leaves show 3 vascular resin canals, interrupted upper hypoderm of very large fibers up to 70 μ in diameter, lower hypoderm absent between stomatal rows, vascular sclereids usually present above or below the bundle (mostly absent in Philippine specimens. Pollen cones fascicled 3–5 in leaf axils, sessile, cylindrical, 2–4.5 cm. long, 2.5–3 mm. in diameter, surrounded at the base by small, broad, spreading scales. Microsporophylls broadly ovate-triangular, acute to somewhat obtuse. Female cones axillary, solitary on peduncles 3–6 mm. long; receptacle of two fused fleshy scales, one somewhat shorter than the other, subtended by 2 subulate, early deciduous bracts. Seed globose or elliptical, about 10 cm. long.

DISTRIBUTION: Low elevations, often coasts, of islands south and east of the South China Sea, and the Malay Peninsula.

Philippine Islands. LUZON: Ilocos Norte, Burgos, Bur. Sci. 27146 *Ramos* (†A); Tayabas, Bur. Sci. 27325 *Quieb* (†A, NY), Bur. Sci. 26902 *Edano* (BRI); For. Bur. 24264 *Cagayan* (A). PALAWAN: For. Bur. 3854 Curran (†NY), For. Bur. 904 *Foxworthy* (NY). NEGROS: western part, *Masias, Sareno & Torrible* in 1925 (†UC). Mindanao: Davao, Pendesan, *Kanehira 2623* (NY).

Malaya. PAHANG: *Henderson 18420* (†UC); Kioala, *Ridley 1441* (†BM). PULAU TIOMAN: Telok Paya, *Anon. s.n.* (†UC). SINGAPORE: Barnes' Island, *G. L. Smith s.n.* (TYPE, †BM); Forest de Kranjo, *Langlasse 72* (†P); *Wallich 6052B* (MO, †P); Mangrove swamp at New John's Street, *Sargent* in 1903 (A–2 sheets); Serangoon, *Ridley 3367* (†MEL); *Hooker & Thomson s.n.* (GH).

Borneo. *Teysmann s.n.* (†MEL). BRITISH NORTH BORNEO: Kuala Penyu, For. Dept. 1798, *Apostal 35* (†UC); Jesselton, *Clemens 51171* (†UC), *9659* (A, BRI, GH, †UC–2 sheets), *9568* (A); *Native collector 2353* (A); *Foxworthy s.n.* (†US).

Bangka: *Teysmann s.n.* (†MEL–2 sheets).

Cultivated. MALAY PENINSULA: Singapore, Bot. Gard., *Furtado* in 1931 (†BRI). JAVA: Buitenzorg Bot. Gard., *Warburg 1210* (†NY), V.F. 1, from Lingga, *Sargent* in 1903 (NY, †UC–3 sheets), *Anon. s.n.* (†DS), V.F. 17a, from Lingga, *Sargent* in 1917 (NY, UC), *Sargent* in 1903 (A–2 sheets, †MO–3 sheets); Bohn's Garden at Buitenzorg, *Sargent* in 1903 (A–2 sheets). AFRICA: Kisantu, Jardin Agronomique, *Vanderyst 31936* (†BR), *Vanderyst 31949* (†BR), *Vanderyst 36983* (†BR); Belgian Congo, Eala, *Corbisier-Baland 1136* (†BR, K, MO, †NY), *Corbisier-Baland 1353* (†BR, K, MO).

Podocarpus polystachyus is quite distinct in having often isolated, extremely large upper hypodermal fibers seen in transverse leaf sections. This character, together with the linear-lanceolate, rigid leaves and the male cones in bundles of 3–5, make possible the positive identification of

the *Corbisier-Baland* and *Vanderyst* specimens from cultivation in Africa. Determination of the former had been questioned and of the latter unknown.

Transverse sections of the leaves do not show auxiliary sclereids in upper or lower mesophyll. However, some cells of the lower mesophyll have thickened and pitted walls but are not devoid of cell contents (except *Henderson 18420*).

The description of *Podocarpus polystachyus* by Wasscher (11) was the first to include specimens from the Philippine Islands. Foxworthy (5) took his description from that of Pilger (1903) which was, in turn, from specimens from the Malay Peninsula and Borneo only. Why Foxworthy was not certain that this species was distinct from *P. elatus* R. Br. is not clear except that the leaves of both are often mucronate. The leaves of *P. elatus* are larger, have parallel margins and the upper hypoderm of much smaller fibers is continuous.

28a. *Podocarpus polystachyus* var. *rigidus* Wasscher, *Blumea* 4: 460. 1941.

Leaves thick-coriaceous, very rigid, more lanceolate and broader with margins not parallel, 3–7.5 cm. long, 8–14 mm. broad; midrib strongly prominent above, often distinctly, broadly and shallowly channelled beneath.

DISTRIBUTION: Riouw Archipelago and Borneo, on mountain slopes and summits.

Borneo: western part, G. Kelam, *Hallier 2373* (†NY).

Wasscher (11) described this variety as differing from the species in its leaf shape, the species having narrower, linear-lanceolate leaves. I do not find this difference so striking; many specimens having some leaves of the described shape must be assigned to the species, the leaves of which may be up to 13 mm. broad. However, in an examination of the transverse section of a leaf fragment from *Hallier 2373*, I find abundant large sclereids in the upper mesophyll which are entirely absent in the species. Some of the lower mesophyll cells show the same thickening of the walls as observed in the species proper. The shallow channel of the lower midrib of this specimen is so constricted as to eliminate the central vascular resin canal.

That *Podocarpus polystachyus* var. *rigidus* is found on mountain slopes and summits is more striking than the small differences in leaf anatomy. The habitat of the species is limited to the low elevations of sea coasts and estuaries.

29. *Podocarpus macrophyllus* (Thunb.) Don in Lamb. *Pinetum* ed. 1. 2: 22. 1824, ed. 2. 2: 123. 1828; Endlicher, *Syn. Conif.* 216. 1847; Blume, *Rumphia* 3: 215. 1847; Carrière, *Traité Conif.* 664. 1867; Parlatores, DC. *Prodr.* 16: 517. 1868; Sieb. & Zucc. in Miquel, *Fl.*

Japon. 2: 70. 1870; Bertrand, Ann. Sci. Nat. V. 20: 59. 1874; Mahlert, Bot. Centralbl. 24: 281. 1885; Van Tieghem, Bull. Soc. Bot. France 38: 169. 1891; Shirasawa, Essenc. Forest. Japon. 1: 31. 1899; Warburg, Monsunia 1: 192. 1900; Kent, Vietch's Man. Conif. 150. 1900; Pilger, Pflanzenreich IV. 5 (Heft 18): 79. 1903, Nat. Pflanzenfam. ed. 2. 13. 1926; Bailey, Cult. Evergreens 179. 1923; Dallimore & Jackson, Handb. Conif. 49. 1923, 1931, 73. 1948; Florin, Svenska Vet.-Akad. Handl. III. 10: 279. 1931; Metcalf, Fl. Fukien 1: 20. 1942.

P. chinensis Blume, Rumphia 3: 216. 1947 non Wall.; Mahlert, Bot. Centralbl. 24: 281. 1885; Florin, Svenska Vet.-Akad. Handl. III. 10: 279. 1931.

Podocarpus chinensis Wallich ex Parlatore, DC. Prodr. 16: 516. 1868.

Taxus macrophylla Thunberg, Fl. Japon. 176. 1784.

A tree 8–15 m. tall, with horizontal branches and numerous, crowded, leafy twigs. Terminal buds ovate, small, the scales ovate with acuminate tips. Leaves crowded, straight, green above, paler beneath, linear-lanceolate, apex long-angustate, acute or obtuse, gradually narrowing at the base to a short petiole, 5.3–10.3 cm. (usually 8–10) long, 6–10 mm. (usually 9–10) broad; midrib prominent above and rather broad, fairly prominent and broader below. Transverse sections of the leaves show 3 resin canals below the vascular bundle, interrupted upper hypoderm of very small fibers (16–20 μ in diameter), no lower hypodermal fibers between the stomatal rows, palisade of 2–3 layers of cells, vascular fibers often present below the vascular bundle and auxiliary sclereids usually absent from the mesophyll. Pollen cones fascicled 3–5, sessile, very narrow-cylindrical, up to 3 cm. long, surrounded at the base by broad triangular, stiffly coriaceous scales. Microsporophylls obtuse with distinct apiculus. Female cones solitary, peduncles 16–17 mm. long; receptacle of 2–3 fused fleshy scales with free tips, subtended by 2 small, narrow, subulate scales 3–4 mm. long. Seeds ovoid, 10–12 mm. long.

China. KIANGSU: Soochow, Dang Wei, *Ching & Tso* 785 (A); Kunshan, *Mrs. Tsiang Ying* 1 (NY). SZECHWAN: *Fang* 1963 (A). CHEKIANG: 20–40 miles west of Wenchow, *Ching* 1892 (†UC); Wenchow, *Ling Kan*, Univ. Nanking 7308 (†UC); Yen Tang Shan, *Chiao*, Univ. Nanking 4737 (A, NY, †UC); Nan-Hoo, *H. H. Hu* 191 (GH); King Yuan, *Ching* 2439 (NY, †UC). CHUSAN: *Home s.n.* (MO). ANWEI: Chemen, *Chung* 3124 (A). KIANGSI: south of Nanchong, Sang-su-ling, *Chung* 2 (A); Lu Shan, *Chiao* 18760 (A). FUKIEN: Amoy, Kulangsu, *Chung* 5775 (A); Puchen, *Chung* 3865 (A). KWANGTUNG: Koo Long Ue, *McClure B-2* (NY); Canton, *Chun* 7731 (NY). YUNNAN: between Muang Hai and Keng Hung, *Rock* 2495 (A), *Bonati* 1802 (†UC). KWEICHOW: Tsunyi, *Tsiang* 5317 (A, NY).

Japan. HONSHU: Mt. Maya, Settsu, *Arimoto* in 1903 (†MO); Idsu (ex Herb. Sokurai), *Wilson* in 1910 (A). KYUSHU: Tairashima, Kawanabe Island, *Ushio* in 1917 (†A); Nagasaki, *Anon.* (ex Herb. Th. Porter) (PH), *Maximowicz* in 1863 (GH, †NY-2 sheets). LOO CHOO ISLANDS, *Wright* 310 (GH, NY).

Cultivated. CHINA: Kwangtung, Tak-Hing, Heung Shan, C.C.C. 13193, *McClure* (†UC). JAPAN: Hondo, *Wilson* in 1911 (ex Herb. Sakurai) (A); Mino

Prov., *Shioto* 8743 (A), *Ugai Kichigoro* 4440 (A). PHILIPPINE ISLANDS: Luzon, Manila, *Fenix* 161 (A). NEPAL: *Netla Thuret* 1889 (A). SINGAPORE: *G.T.* (ex Herb. Hook. & Thomson) (GH). SWITZERLAND: Locarno, Bot. Gard., *Baenitz* in 1905 (ILL). ENGLAND: Kew, Royal Bot. Gard., *Cook* in 1937 (ILL). UNITED STATES: New York Bot. Gard. 3750, from C.P. 1900, *Hartling* in 1919 (ILL); California, Goleta, *Anon. s.n.* (†ILL). WEST INDIES: Jamaica, Chinchona Gardens, *Buchholz* in 1946 (ILL); Trinidad, Roy. Bot. Gard., *Ewan* 17014 (†MO); Tobago, Castleton Gardens, *Harris* 45, 50, *Broadway* 2934 (K).

Transverse sections of the leaves of *Podocarpus macrophyllus* and its varieties are ordinarily quite easily recognized by the thick, usually doubled, layer of palisade mesophyll and the interrupted upper hypoderm of small fibers. This is very useful as the species is highly successful in cultivation and the original source of the material has frequently long been forgotten. Often it seems to be misidentified as *P. elongatus*, an African species, which has distinct marginal resin canals.

Stiles (10) selected the leaf of *Podocarpus macrophyllus* for his description of the anatomy most typical of *Podocarpus*. That the plant he used was probably the variety *maki* does not invalidate the description, for the leaves have the same anatomy and are merely shorter and narrower. He indicated that he observed "slight" differences in the quantity of transfusion tissue, accessory transfusion tissue and sclerenchyma in *P. elatus* and *P. polystachyus*, but attributed these differences to external conditions. I find, however, on examination of a larger number of specimens, that continuous upper hypoderm is a consistent character of *P. elatus*, and the hypodermal fibers are much larger in diameter in *P. polystachyus*. Orr (9) found that the above characters provided distinguishing differences for these species.

29a. *Podocarpus macrophyllus* var. *angustifolius* Blume, *Rumphia* 3: 215. 1847; Pilger, *Pflanzenreich* IV. 5 (Heft 18): 80. 1903.

This variety differs from the species in having narrower leaves which are quite variable in length, being both shorter and longer on a single plant than the extremes for the species. The linear-lanceolate leaves have also a more tapering apex.

DISTRIBUTION: A few specimens from both China and Japan but best known from cultivation in the United States.

China. KWANGTUNG: *Canton Christian College Herb.* 13193 (†UC); Canton, *Read* (PH). KIANGSU: Tungtin, Soochow, Tai Hu Lake, *Ching & Tso* 730 (A). North Burma: Nmai Hka Valley, *Ward* 521 (A). Japan. HONSHU: Yamato River in Nara Park, *Wilson* 7855 (A); Kanagawa-Ken, between Kamakura & Zushi, *Beattie & Kwihara* 10449 (A). HACHIJO ISLANDS: *Wilson* 8391 (A). Locality not indicated: *Anon.* (ex Herb. Lugd. Batav.) (†BR-2 sheets, NY).

Cultivated. JAPAN: LiuKiu Islands, Yokohama Nursery, *Wilson s.n.* (A). JAVA: *Zollinger s.n.* (†BR). AUSTRALIA: Brisbane Bot. Gard., *White* 9283 (A). EUROPE: Germany, Hannover Bot. Garden #6, *Zabel* in 1892 (A). WEST INDIES: Tobago Bot. Station, *Broadway* 2934 (F, †MO-2 sheets, NY); Trinidad,

Port of Spain, *Broadway* in 1933 (A); Trinidad, St. Augustine, *Baker 14554* (TRIN); Martinique, Basse Pointe, *Duss 2096* (†NY). CUBA: Prov. Santa Clara, Harvard Trop. Gard., *Jack 8353* (A, NY, US). UNITED STATES. California: Los Angeles, *Buchholz* in 1940 (A, †ILL-3 sheets), *Buchholz* in 1942 (†ILL), *van Rensselaer 1713* (ILL), *Brown* in 1938 (CAS), *Rollins & Chambers* in 1938 (GH), *Turner* in 1926 (CAS); San Francisco, Golden Gate Park Arboretum, *Buchholz* in 1942 (†ILL), *Walther* in 1942 (A); Santa Barbara, Orpets Nursery, *van Rensselaer 1718* (†ILL). Texas: Houston, *Fisher 44301* (F). New Jersey: New Brunswick, Rutgers Greenhouse 1B, *Johnston* in 1952 (†RUT), from CU1, Atkins Garden, Cuba, *Johnston* in 1952 (†RUT). New York: Botanical Garden Greenhouse #3635 from D.P.M. 1900, *Nash* in 1905, #3750 from D.P.M. 1900, *Taylor* in 1906, #15022 from Edinb. 1902, *Taylor* in 1905 (NY).

Podocarpus macrophyllus var. *angustifolius* is widely cultivated in southwestern and southern United States where it is used mostly in trimmed hedges, sometimes as a shrub or small tree. It is also extensively used as a green foliage in floral arrangements. It frequently passes under the names *P. chinensis* or *P. sinensis*, and is commonly called the "Southern Yew."

29b. *Podocarpus macrophyllus* var. *chingii*, var. nov.

Arbor columnaris, 8 m. alta, ramulis adscendentibus; foliis crassis rigidis, oblanceolatis, 1.2–3 cm. longis, 3–4 mm. latis, valde gradatim attenuatis in petiolo brevissimo, apicibus plerumque obtusis, marginibus interdum revolutis; strobilis masculis alabastris globosis, 1.5 mm. diametro, 1–3-fasciculatis, squamis tenuibus, late triangularibus, obtusis, imbricatis, strobilis maturis tenuibus, ad 2.5 cm. longis; strobilis femineis ignotis.

Tree with trunk up to 10 cm. in diameter; bark fibrous and brown; young twigs green. Terminal buds very small, conical; outer scales only up to 3 mm. long, carinate, somewhat tapered to the thick apex, the tips occasionally spreading. Leaves small, densely crowded, erect, linear-oblong to narrowly spatulate, the apex acute to rounded, the midrib very sharply prominent above, broader and flat below.

DISTRIBUTION: Known from only the type locality, in Chekiang, China.

China. CHEKIANG: 55 Chinese miles (li) west of Lung-sien, alt. 100 m., *Ching 2477* (TYPE, †A).

The striking columnar habit and the very small leaves distinguish this variety. It most closely resembles *Podocarpus macrophyllus* var. *maki*, the foliage being a miniature of that variety. The foliage does not differ greatly from that of *P. brevifolius* which has the leaves mostly larger and tapering more quickly toward the base. The latter species, however, is a tree with stout, spreading branches and solitary male cones.

29c. *Podocarpus macrophyllus* var. *maki* Endlicher, Syn. Conif. 216. 1847; Sieb. et Zucc. in Miquel, Fl. Japon. 2: 70. 1870; Dallimore & Jackson, Handb. Conif. 49. 1923, 1931, 74. 1948.

Podocarpus macrophyllus ssp. *maki* Sieb. Naamlijst 35. 1844; Pilger, Pflan-

zenreich IV. 5 (Heft 18): 80. 1903, Nat. Pflanzenfam. ed. 2. 13: 248. 1926; Wasscher, Blumea 4: 461. 1941.

Podocarpus chinensis Wall. in Endl. Syn. Conif. 215. 1847; Blume, Rumphia 3: 216. 1847; Bertrand, Ann. Sci. Nat. V. 20: 59. 1847; List N.6051 ex Carrière, Traité Conif. ed. 2. 658. 1867; Parlatores, DC. Prodr. 16: 516. 1868; Warburg, Monsunia 1: 192. 1900.

Podocarpus japonica Sieb. Ann. Soc. Hort. Pays-Bas 35. 1844.

Podocarpus makoyi Blume, Rumphia 3: 215. 1847.

Podocarpus miquelia Hort. ex Parlatores, DC. Prodr. 16: 516. 1868.

Podocarpus sinensis (?) Favre in Ann. Sci. Nat. V. 3: 379. 1865.

Podocarpus vrieseana Hort. ex Parlatores, DC. Prodr. 16: 516. 1868.

Small tree or shrub with erect branches and thickly leafy twigs. Leaves straight, erect to spreading, linear-lanceolate, obtuse or shortly angustate at the tip, gradually narrowing to the short petiole, 3.5–7 cm. long, 4.5–7 mm. wide; midrib narrowly prominent above. Male cones sessile, in clusters of 3–5 in upper leaf axils, strobili narrowly cylindrical, nearly filiform, 3–4.5 cm. long, 2–3 mm. in diameter; microsporophylls triangular, acute, apiculate. Female cones solitary in leaf axils on peduncles 5–11 mm. long; the fleshy receptacles of 2–3 fused scales subtended by 2 small subulate bracts. Seeds elliptical, 8–10 mm. long, 6–7 mm. in diameter.

DISTRIBUTION: A few specimens of this variety from China, North Burma, Japan and Formosa seem to have come from wild habitats. It is best known from its successful wide cultivation not only in Japan, its probable source, but throughout the world in the milder climates.

China. CHEKIANG: southern part, between Ping Yung and Tai Suan, *Ching* 2168 (A, NY, †UC); Tsing-Yun Dist., Peach Mountain, *Keng* 438 (A); Chusan & Ningpo, *Capt. Home* in 1892 (BM), *Ching* 2439 (†UC). KWANTUNG: Wat Shui Shan, *Chun* 7343 (A), *Wang & Ling* 7343 (†UC); Su-liu-kwan, Lofou Shan, *Tsiang* 1750 (A), Heunghsan, *Chun* 97 (NY); Canton, *Anon.* in 1889 (†MO). Locality unknown: ex Herb. Prager, *Anon. s.n.* (†CAS), *Bonati & Lure* 1802 (†UC), ex Univ. Nanking, *Chiao* in 1925 (†UC). **North Burma:** 'Nmai Hka Valley, *Kingdon Ward* 521 (NY). **Japan.** HONSHU: Oshima, Prov. Izu, *Mizushima* 815 (A); Hondo, *Shioto* in 1935 (†A); Hakone and Tokyo, *Hartshorne* in 1894 (PH); Sin, *Zollinger* 161 (A). KYUSHU: Kagosima, *Masamune* in 1922 (NY). No specific locality in Japan: *Thunberg s.n.* (†UPS), *Lejeuni s.n.* (†BR), ex Herb. Lugd.-Batav., *Anon. s.n.* (†BR, NY), ex Scheidweiler Herb., *Anon. s.n.* (†BR), 6051A Wall. Cat., *Lindley s.n.* (NY), ex Herb. College S. S. Trin., *Harvey* (GH), ex Herb. Lugd.-Batav., *T. s.n.* (GH), *Anon.* 2 (MEL), ex Hernhard Herb., *Goring* 181 (MO). **Formosa:** Taitôtyô, Suibotei, *Suzuki-Tokio* 19678 (A); Urajiro-maki Taichu Prefecture, *Hayata & Mori* 7147 (A). Origin unknown: part of specimens on *Wall.* 6052A, not *P. neriifolius* (†BR).

Cultivated. CHINA. Kiangsu: Nanking, *Chen & Teng* 4104 (UC); Maan Shan Inin Shan, *Tso* 1634 (A); Tungting, Tai Hu Lake, Soochow, *Ching & Tso* 731 (A). Hupeh: *Ho-Ch'ang Chow* 1972 (A, NY). Fukien: Foochow, West Lake Park, *Chang* 4360 (†MO); Wooshihshau, *Chung* 2491 (A, UC); Electric Factory Garden, *Chung* 2700 (A, UC); Hinghwa, *Chung* 1304 (A), 7515 (A); Amoy region, Kulangser, *Chung* 1635 (A, UC). SINGAPORE: Bot. Gard., *Sargent* in 1903 (A), Bohn's Gard., *Sargent* in 1903 (A). JAPAN: ex Hort. Cantab. *Anon.* in 184–(NY), Tokyo Gardens, *Faurie* 59 (MO). CEYLON: Hakgala Bot. Gard., *Wilson*

in 1921 (†A). MONACO: Hort. Monac., *Anon.* in 1824 (†BR). SWITZERLAND: Locarno, ex Schneider Herb., *Anon. s.n.* (†A). FRANCE: Riviera, *Schneider s.n.* (†A). ENGLAND: *Lucas 1777* (†BM), Kew, *Anon. s.n.* (MO). ITALY: ex Herb. R. Bot. Hort. Neap., *Anon.* in 1868. (†MO), ex Bernhardt Herb., *Anon. s.n.* (†MO), ex Horti Thenensis Herb. *Bossche 1375* (†BR). AFRICA: Cape of Good Hope, *Anon.* in 1836 (†MO), Hort. Daudin, *Anon.* in 1851 (†DS); Grootvaderbosch, *Thunberg s.n.* (†UPS). MAURITIUS OR MADAGASCAR: *Blackburn* in 1873 (†CU). VENEZUELA: Caracas, *Pittier* in 1924 (†VEN), *Orozco 324* (†F). BRAZIL: Rio de Janeiro Bot. Gard., *Curran* in 1915 (†US), *deLaubenfels* in 1952 (†ILL). WEST INDIES: *Broadway 2934* (†F); Trinidad, Port of Spain, *Broadway s.n.* (BM); Jamaica, *Chrysler 1914* (NJU), *Anon. s.n.* (†ILL). UNITED STATES. New York: New York Bot. Gard. 3750A from DPM 1900, *Taylor* in 1906 (NY), *Hartling* in 1914 (NY), *Nash* in 1905 (NY), *Anon.* in 1920 (ILL). New Jersey: Greenhouse at Rutgers, *Johnson* in 1952 (†NJU). District of Columbia: Washington, Congressional Garden, *Parry* in 1918 (US). South Carolina: Columbia, *Hough* in 1916 (CAS); Charleston, *Sargent* in 1914 (A). Georgia: Augusta, *Cuthbert* in 1896 (NJU); Cairo, *Wight* in 1948 (†ILL). Florida: Gotha, Nehrling's Place, *Rehder* in 1920 (A); Glen St. Mary, *Hume* in 1926 (A); Winter Haven, *McFarlin 4944* (MICH); Panama City, Tyndall Field Hospital area, *Gray* in 1945 (†ILL); Jacksonville, *Huger* in 1922 (NY), *Dahlgren* in 1945 (F). Missouri: St. Louis, Bot. Gard., *Woodson 321* (MO), *Irish* in 1896 (MO), *G. E.* in 1873 (MO), *Englemann* in 1877 (MO). Louisiana: New Orleans, *Kock* in 1936 (CU). California: Hales place, Santa Barbara, *Walther* in 1921 (†CAS). JAVA: Hort. Bot. Gard. Buitenzorg, VF 18, *Anon.* 1903 (NY-2 sheets), VF 16, *Anon.* in 1903 (NY). NEW GUINEA: Aiyura, *Womersley NGF3397* (LAE). AUSTRALIA: Brisbane, private garden, *White 3311* (A).

This variety is distinguished from the species by the narrower and shorter leaves, not over 7 cm. long nor 7 mm. wide. The anatomy of the leaf in transverse section does not differ from that of the species.

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